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- (54) **23-Oxo (keto) and 23-imino derivatives of mono- and diepoxy LL-F28249 compounds.**

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Description

BACKGROUND OF THE INVENTION

The present invention relates to new 23-oxo (keto) and 23-imino derivatives of the compounds C(26,27)-epoxy and C(14,15;26,27)-diepoxy-LL-F28249 compounds collectively defined as LL-F28249. These LL-F28249 compounds are produced by the fermentation of the microorganism *Streptomyces cyaneogriseus* subspecies *noncyanogenus* having deposit accession no. NRRL-15773. The morphological characteristics, compounds and methods for their production are disclosed in European Application No. 170,006. The C(26,27)-epoxy- and C(14,15;26,27)-diepoxy-LL-F28249 compounds are derived by epoxidation of the LL-F28249 compounds.

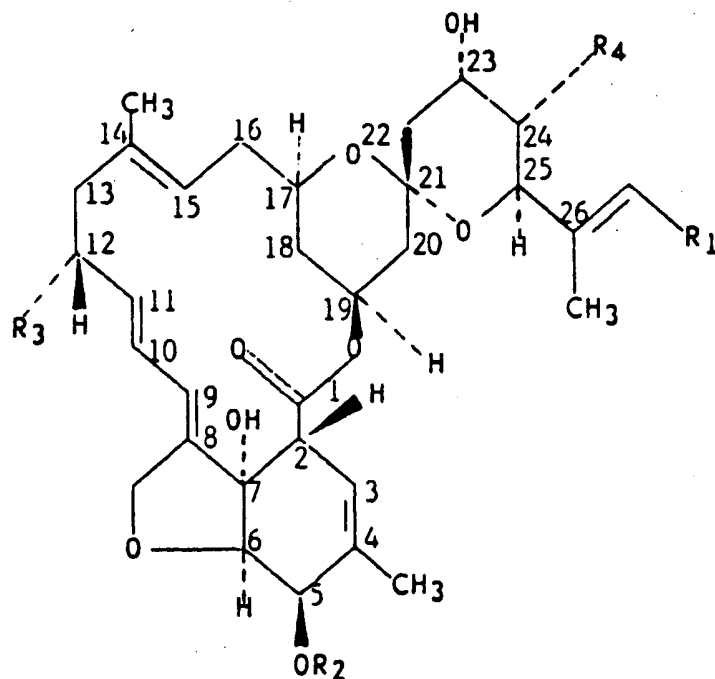
In non-prepublished documents EP-A-0 241 146 and EP-A-0 283 259 compounds having a similar structure with a different substitution pattern are disclosed. Further, similar compounds are described in EP-A-0 215 654, which have no epoxide oxygen at the C-26 and C-27 positions.

The C(26,27)-epoxy- and C(14,15;26,27)-diepoxy-LL-F28249 α , β , ϵ , ζ , θ and ι compounds are complex macrolids which have a 23-hydroxy substituent, as well as hydroxy groups at the 5 and 7 positions. The selective oxidation of the 23-hydroxy group to a 23-oxo (keto) group and the subsequent derivatization of the oxo group to afford 23-imino derivatives are the subject matter of the present invention. These 23-oxo (keto) and 23-imino derivatives of the C(26,27)-epoxy and C(14,15;26,27)-diepoxy-LL-F28249 α , β , ϵ , ζ , θ and ι compounds are useful for the prevention, treatment or control of helminths, ectoparasites, insects, acarids and nematodes in warm-blooded animals and agricultural crops.

SUMMARY OF THE INVENTION

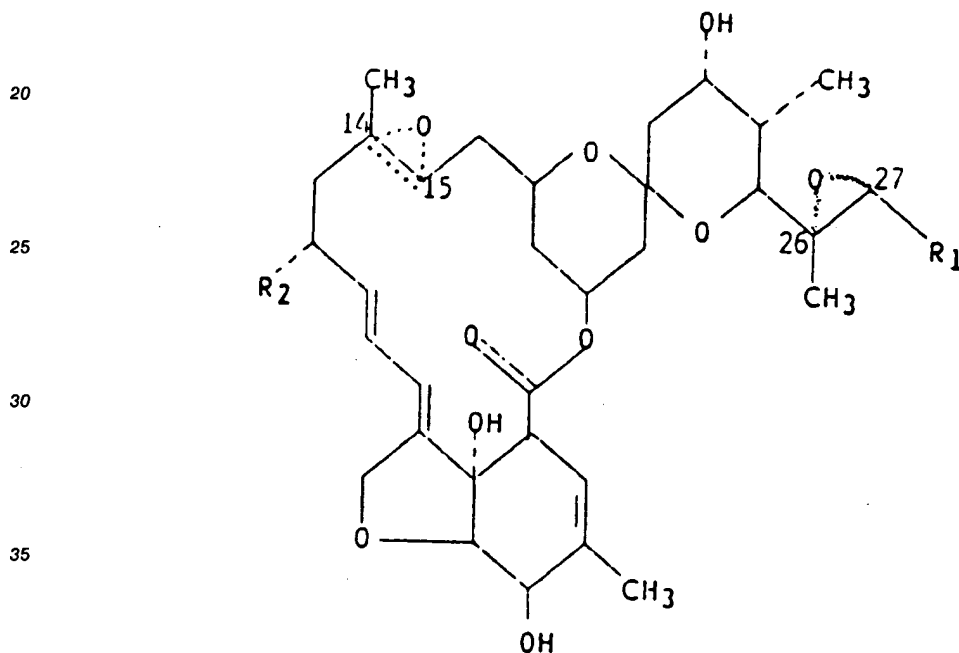
The present invention provides novel 23-oxo (keto) and 23-imino derivatives of C(26,27)-epoxy- and C(14,15;26,27)-diepoxy-LL-F28249 α , β , ϵ , ζ , θ and ι .

The LL-F28249 compounds have the following structural formula:



Compon nt	R ₁	R ₂	R ₃	R ₄
LL-F28249 α	CH(CH ₃) ₂	H	CH ₃	CH ₃
LL-F28249 β	CH ₃	H	CH ₃	CH ₃
LL-F28249 ϵ	CH(CH ₃) ₂	H	H	CH ₃
LL-F28249 ζ	CH ₂ CH ₃	H	CH ₃	CH ₃
LL-F28249 θ	CH(CH ₃) ₂	H	CH ₃	CH ₂ CH ₃
LL-F28249 ι	CH(CH ₃) ₂	H	CH ₂ CH ₃	CH ₃

The C(26,27)-epoxy- and C(14,15;26,27)-diepoxy-LL-F28249 α , β , ϵ , ζ , θ and ι have the following structure,



wherein R₁ is methyl or isopropyl; R₂ is hydrogen, methyl or ethyl; and the dotted triangular figure with oxygen at C(14,15) indicates that either a double bond or an epoxide is present.

The compounds of the present invention are useful anthelmintics, ectoparasiticides, insecticides, acaricides and nematocides in treating, preventing or controlling such diseases in warm-blooded animals, such as poultry, cattle, sheep, swine, rabbits, horses, dogs, cats and human beings and agricultural crops.

Although these diseases have been recognized for years and therapies exist for the treatment and prevention of the diseases, the present invention provides therapeutically or pharmaceutically effective amounts of the present novel compounds. For instance, U.S. Application for Letters Patent Serial Numbers 907,283, 907,188, 907,281, 907,259, 907,187 and 907,284 of Asato and Asato et al, filed on September 12, 1986, provide compounds for such treatments.

U.S. Patent 3,950,360, Aoki et al, April 13, 1976 discloses certain antibiotic substances obtained by culturing a *Streptomyces* microorganism, said compounds being useful as insecticides and acaricides. Further, an entire series of U.S. patents relates to certain compounds produced by the fermentation of *Streptomyces avermitilis* (U.S. Patent 4,171,314, Chabala et al, October 16, 1979; U.S. Patent 4,199,569, Chabala et al, April 22, 1980; U.S. Patent 4,206,205, Mrozik et al, June 3, 1980; U.S. Patent 4,310,519, Albers-Schonberg, January 12, 1982; U.S. Patent 4,333,925, Buhs et al, June 8, 1982). U.S. Patent 4,423,209, Mrozik, December 27, 1983 relates to the process of converting some of these less desirable components to more preferred ones. Finally, British Patent Application No. 2166436 A discloses antibiotics

also, as does Belgium Patent Application 904,709A.

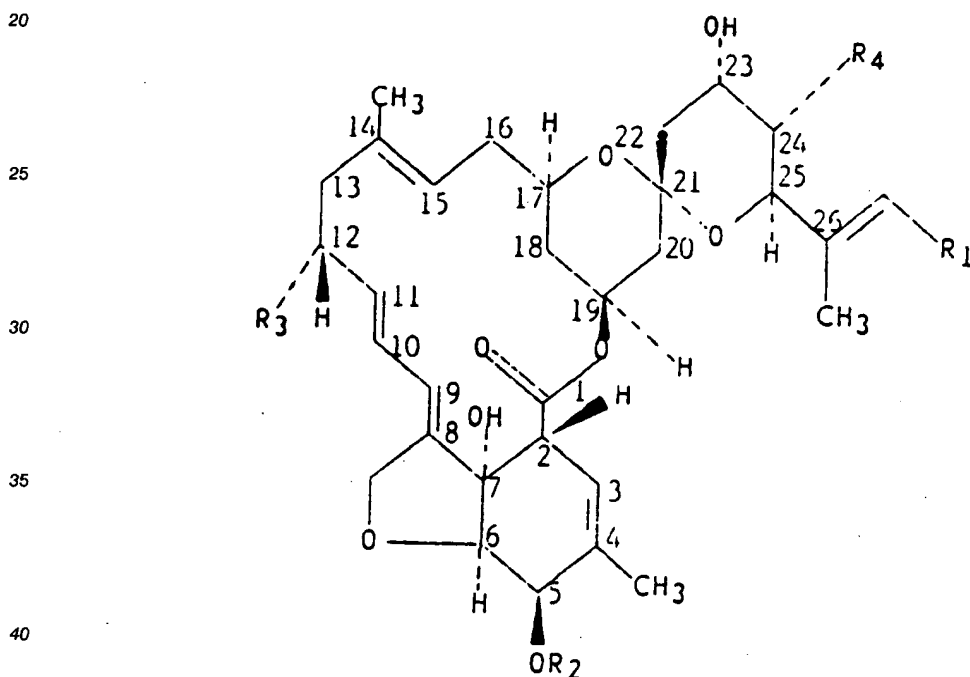
The present compounds or the pharmaceutically and pharmacologically acceptable salts thereof exhibit excellent and effective treatment, prevention and/or control of these serious diseases of warm-blooded animals.

5 It is an object of the present invention, therefore, to provide novel C(26,27)-epoxide and C(14,15; 26,27)-diepoxide derivatives of LL-F28249 α , β , ϵ , ζ , θ and ι . It is a further object to provide a process for the preparation of these derivatives and to provide methods for preventing, treating or controlling endo- and ectoparasitic (collectively parasitic) insect, nematode and acarid infections and infestations in warm-blooded animals and agricultural crops by providing compositions containing prophylactically, therapeutically,
10 pharmaceutically or pesticidally effective amounts of the present compound. A further object of these compounds is as intermediates for the preparation of other novel antiparasitic and insecticidal compounds.

These and other objects of the invention will become apparent by the more detailed description of the invention provided hereinbelow.

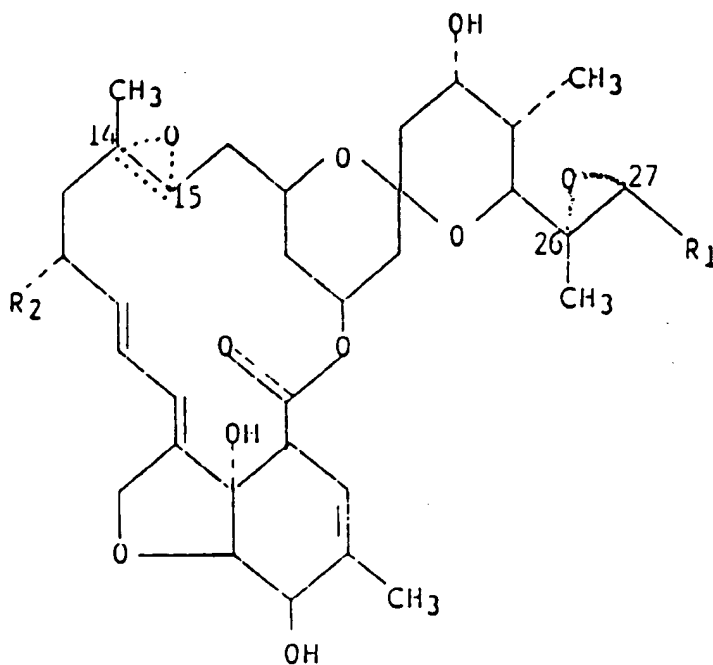
15 DETAILED DESCRIPTION OF THE INVENTION

The LL-F28249 compounds have the following structural formula,



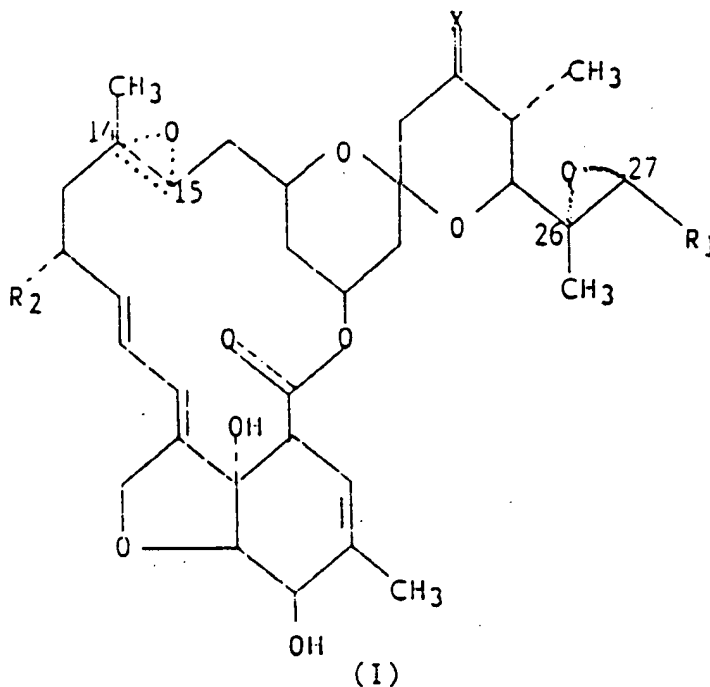
Component	R_1	R_2	R_3	R_4
LL-F28249 α	$\text{CH}(\text{CH}_3)_2$	H	CH_3	CH_3
LL-F28249 β	CH_3	H	CH_3	CH_3
LL-F28249 ϵ	$\text{CH}(\text{CH}_3)_2$	H	H	CH_3
LL-F28249 ζ	CH_2CH_3	H	CH_3	CH_3
LL-F28249 θ	$\text{CH}(\text{CH}_3)_2$	H	CH_3	CH_2CH_3
LL-F28249 ι	$\text{CH}(\text{CH}_3)_2$	H	CH_2CH_3	CH_3

The C(26,27)-epoxy- and C(14,15;26,27)-diepoxy-LL-F28249 α , β , ϵ , ζ , θ and ι have the following structure,



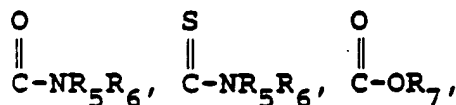
wherein R_1 is methyl or isopropyl; R_2 is hydrogen, methyl or ethyl; and the dotted triangular figure with oxygen at C(14,15) indicates that there is present either a double bond or an epoxide is present.

The compounds of the present invention are represented by the following structural formulae (I),

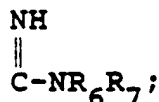


wherein R_1 is methyl or isopropyl; R_2 is hydrogen, methyl or hydrogen; X is oxygen, NOR_3 , or $N-NHR_4$; R_3 is hydrogen, C_1 - C_6 alkyl, benzyl, allyl, propargyl, phenyl, CH_2COO -alkyl (C_1 - C_4), N -(C_1 - C_6 alkyl)carbamoyl, N -(allyl)carbamoyl, N -(propargyl)carbamoyl, N -(phenyl)-carbamoyl, N -(chlorophenyl)carbamoyl, N -

(dichlorophenyl)carbamoyl, N-(benzyl)carbamoyl, C₁-C₆ alkanoyl, chloroacetyl, methoxyacetyl, phenylacetyl, benzoyl and chlorobenzoyl; R₄ is

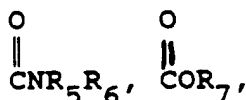


C₁-C₄ alkanoyl, C₁-C₄ alkyl, or



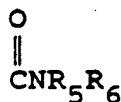
R₅ and R₆ are hydrogen or C₁-C₄ alkyl; and R₇ is C₁-C₄ alkyl; and the dotted triangular figure with oxygen at C(14,15) indicates that either a double bond or an epoxide is present, with the proviso of claim 1.

Preferably, R₁ is isopropyl; R₂ is methyl; X is oxygen, NOR₃ or NNHR₄; and R₄ is



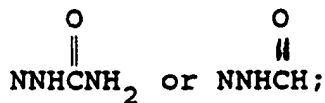
C₁-C₄ alkanoyl or C₁-C₄ alkyl.

Another preferred compound is represented by R₁ being isopropyl; R₂ being methyl; X being oxygen, NOR₃ or NNHR₄; R₄ being



or C₁-C₄ alkanoyl; and the dotted triangular figure with oxygen at C(14,15) being a double bond.

The most preferred compound is represented by R₁ being isopropyl; R₂ being methyl; X being oxygen, NOCH₃,



and the dotted triangular figure with oxygen at C(14,15) being a double bond.

The monoepoxide and diepoxide compounds which are precursors of the novel compounds of this invention are prepared by treating the appropriately protected LL-F28249 compound with a mild oxidising agent at temperatures less than -15 °C. The oxidant useful in the present invention is capable of selectively oxidizing the C(26,27) double bond as well as the C(14,15) double bond, but will leave other double bonds in the molecule intact. Selectivity also is attained by controlling the temperature of the oxidation in an inert solvent, such as methylene chloride or chloroform. Peroxide oxidizing agents, such as *m*-chloroperoxybenzoic acid, are representative of the preferred oxidants in preparing the monoepoxy and diepoxy compounds of the present invention.

Generally, a slight excess of the oxidizing agent is employed such as 5%-20% excess, when it is desired to prepare the C(26,27) epoxide in good yield. When epoxidation at C(14,15) double bond also is desired equivalent to a slight excess of 2 moles is employed.

The epoxidation is generally conducted at temperatures less than -20 °C to -78 °C and is complete in 3-6 hours. Separation of the monoepoxide and the diepoxide is readily achieved by standard chromatographic

techniques, such as column or preparative-plate chromatography.

The starting materials for the compounds of the present invention are the above-mentioned LL-F28249 fermentation products. These compounds are initially derivatized at the 5- and 23-hydroxy groups with a trisubstituted alkyl silyl group. A preferred protecting group is t-butyldimethylsilyl. The reaction is carried out by allowing the LL-F28249 compound to react with two molar equivalents of a substituted silyl halide, preferably a silyl chloride in an aprotic solvent such as dimethylformamide or ethylene dichloride in the presence of imidazole and/or 4-dimethylaminopyridine. The reaction is completed in 2-8 hours at 50 °C to 80 °C.

The silyl group is removed after epoxidation by stirring the silyl derivative in methanol containing an acid, such as p-toluenesulfonic acid monohydrate or acetic acid. The reaction is complete in 1-8 hours at 0 °C to 25 °C, preferably at 0 °C to 10 °C. It also is especially beneficial if this reaction is conducted in the presence of a catalytic amount of FeCl₃.

In preparing the compounds of the present invention, the 5-hydroxy group is protected following the epoxidation. Therefore, prior to the oxidation of the 23-hydroxyl group to the 23-oxo or keto group, the 5-hydroxyl group is protected. Suitable protecting groups are trisubstituted silyl groups, such as t-butyl-dimethylsilyl and trimethylsilyl, or trisubstituted silyloxyacetyl groups, such as t-butyldimethylsilyloxy acetyl group. The protecting groups, however, are not limited to these groups since other useful protecting groups such as acyl and substituted acyl, such as acetyl, trifluoroacetyl, chloroacetyl, trichloroacetyl or phenox-yacetyl, also are useful in the process of the present invention.

One of the preferred protecting groups is t-butyldimethylsilyl. This group is attached to the 5-hydroxyl group by reacting an unprotected 5-hydroxy C(26,27)-epoxy- or C(14,15;26,27)-diepoxy-LL-F-28249 compound with t-butyldimethylsilyl chloride in the presence of a base, such as imidazole, pyridine, 4-dimethylaminopyridine or triethylamine, in an aprotic solvent such as methylene chloride, toluene, ethylacetate, tetrahydrofuran or ethylenedichloride. The reaction is stirred at a temperature of about 0 °C to 30 °C, and the reaction is complete in several hours, depending on the temperature of the reaction. The completion of the reaction is usually monitored by high performance liquid chromatography (HPLC) using reverse phase on a Whatman Partisil CCS/C₈ rapid analysis column.

Another preferred protecting group is t-butyldimethylsilyloxy acetyl group. This group is attached to the 5-hydroxyl group by combining the unprotected C(26,27)-epoxy- or C(14,15;26,27)-diepoxy-LL-F28249 compound in an aprotic solvent such as methylene chloride, toluene, ethyl acetate, tetrahydrofuran or ethylenedichloride, containing a tertiary amine, such as pyridine or triethylamine, and adding the protecting agent in the form of an acid halide. The reaction is conducted at a temperature of about 0 °C to 30 °C and is monitored by HPLC for completion.

The 23-hydroxyl group of the protected C(26,27)-epoxy- or C(14,15;26,27)-diepoxy-LL-F28249 compound then is oxidized to the 23-oxo (or keto) group by using oxidizing agents such as pyridinium dichromate, pyridinium chlorochromate, chromic acid-dimethylpyrazole, acetic anhydride/dimethylsulfoxide, trifluoroacetic anhydride/dimethylsulfoxide, N-chlorosuccinimide/dimethylsulfoxide or oxalyl chloride/dimethylsulfoxide. The reaction is carried out at dry-ice bath temperatures (about -78 °C) to room temperature (about 25 °C) and is complete in about 1 to 24 hours, depending on the rate of oxidation, which is monitored by HPLC. The dimethylsulfoxide oxidation procedures are carried out in the presence of triethylamine or diisopropylethylamine. Solvents such as methylene chloride, ethylenedichloride, dimethyl-formamide or dimethylsulfoxide are used. In using oxalyl chloride/dimethylsulfoxide in the presence of triethylamine, it is advantageous to add molecular sieves to the reaction mixture to increase the yield. The oxidation may also be carried out by soil microorganisms using 100 mg to 10 g of a 23-hydroxy compound per liter of unsterilized soil at 20 °C to 30 °C. The oxidized 23-keto compound is extracted from the soil by a solvent such as acetone, methanol or ethanol.

The silyl protecting group is removed by stirring a protected 23-keto-C(26,27)-epoxy or C(14,15; 26,27)-diepoxy-LL-F28249 compound in a lower alkanol such as methanol at 0 °C to room temperature for about 0.5 hour to an hour in the presence of an acid such as p-toluenesulfonic acid. If the protecting group is a silyloxyacetyl group, the silyl group is removed with acid as described above, and the hydroxyacetyl group is cleaved with an equivalent of base such as sodium methoxide in methanol at 0 °C to room temperature in 0.5 hour to several hours. The silyloxyacetyl group may also be removed in one step by treatment with sodium methoxide at room temperature until the reaction is complete. Similarly, other acyl protecting groups are removed by base treatment.

The imino derivatives of the 23-oxo compounds are readily prepared by standard techniques such as procedures described by S. M. McElvain in *The Characterization of Organic Compounds*, published by MacMillan Company, New York, 1953, pages 204-205 and incorporated herein by reference.

Typically, a 23-oxo compound is stirred in alcohol, such as methanol or ethanol, or dioxane in the presence of acetic acid and an excess of the amino derivatizing agent, such as hydroxylamine hydrochloride, O-methylhydroxylamine hydrochloride or semicarbazide hydrochloride along with an equivalent amount of sodium acetate, at room temperature to 50°C. The reaction is usually complete in several hours to several days at room temperature but can be readily speeded by heating.

The O-acyloximes or carbamoylated oximes are prepared by treating the oximes of structure (I) with acid anhydrides or isocyanates to afford (I), wherein R₄ is C₁-C₆ alkanoyl, chloroacetyl, methoxyacetyl, phenylacetyl, benzoyl, chlorobenzoyl, N-(C₁-C₄ alkyl)carbamoyl, N-(allyl)carbamoyl, N-(propargyl)carbamoyl, N-(phenyl)carbamoyl, N-(chlorophenyl)carbamoyl, N-(dichlorophenyl)carbamoyl or N-(benzyl)carbamoyl. The reactions are conducted in inert solvents, such as methylene chloride, ethylenedichloride or dioxane, in the presence of a tertiary amine, such as triethylamine or diisopropylethylamine. Generally, the reactions are conducted from 0°C to room temperature, but if the reactions are sluggish, heat is applied. An equivalent to a slight excess of the acid anhydride is used to avoid reaction at the 5-hydroxy group.

The novel compounds of the present invention have significant activity as anthelmintics, ectoparasitocides, insecticides, nematocides and acaricides in human and animal health areas and in agriculture.

The disease or group of diseases described generally as helminthiasis is due to infection of an animal host with parasitic worms known as helminths. Helminthiasis is a prevalent and serious economic problem in domesticated animals such as swine, sheep, horses, cattle, goats, dogs, cats and poultry. Among the helminths, the group of worms described as nematodes causes widespread and often times serious infection in various species of animals. The most common genera of nematodes infecting the animals referred to above are *Haemonchus*, *Trichostrongylus*, *Ostertagia*, *Nematodirus*, *Cooperia*, *Ascaris*, *Bunostomum*, *Oesophagostomum*, *Chabertia*, *Trichuris*, *Strongylus*, *Trichonema*, *Dictyocaulus*, *Capillaria*, *Heterakis*, *Toxocara*, *Ascaridia*, *Oxyuris*, *Ancylostoma*, *Uncinaria*, *Toxascaris* and *Parascaris*. Certain of these, such as *Nematodirus*, *Cooperia*, and *Oesophagostomum* primarily attack the intestinal tract while others, such as *Haemonchus* and *Ostertagia*, are most prevalent in the stomach. Still others such as *Dictyocaulus* are found in the lungs. Also, other parasites may be located in other tissues and organs of the body such as the heart and blood vessels, subcutaneous and lymphatic tissue. The parasitic infections known as helminthiasis lead to anemia, malnutrition, weakness, weight loss, severe damage to the walls of the intestinal tract and other tissues and organs, and if left untreated, may result in death of the infected host. The 23-oxo or -imino derivatives of the C(26,27)-epoxy or C(14,15;26,27)-diepoxy-LL-F28249 compounds of this invention unexpectedly have high activity against these parasites.

Additionally, they also are active against *Dirofilaria* in dogs, *Nematospiroides*, *Syphacia*, *Aspicularis* in rodents, arthropod ectoparasites such as ticks, mites, lice, fleas, blowfly of animals and birds, the ectoparasite *Lucilla* sp. of sheep, biting insects and migrating dipterous larvae such as *Hypoderma* sp. in cattle, *Gastrophilus* in horses and *Cuterebra* sp. in rodents.

The compounds of the present invention also are useful in treating, preventing or controlling parasites which infect human beings, as well. The most common genera of parasites of the gastrointestinal tract of man are *Ancylostoma*, *Necator*, *Ascaris*, *Strongyloides*, *Trichinella*, *Capillaria*, *Trichuris*, and *Enterobius*. Other medically important genera of parasites which are found in the blood of other tissues and organs outside the gastrointestinal tract are the filarial worms such as *Wuchereria*, *Brugia*, *Onchocerca* and *Loa*, *Dracunculus* and extra-intestinal stages of the intestinal worms *Strongyloides* and *Trichinella*. The present compounds also are of value against arthropods parasitizing man, biting insects and other dipterous pests causing annoyance to man.

These compounds further are active against household pests such as the cockroach, *Blattella* sp., clothes moth, *Tineola* sp., carpet beetle, *Attagenus* sp., and the housefly *Musca domestica*.

Insect pests of stored grains such as *Tribolium* sp., *Tenebrio* sp., and insect and acarid pests of agricultural plants such as spider mites (*Tetranychus* sp.), southern army worms, tobacco budworms, boll weevils, aphids (*Acyrtosiphon* sp.), migratory orthopterans such as locusts and immature stages of insects living on plant tissue are controlled by the present compounds as well as the control of soil nematodes and plant parasites such as *Meloidogyne* sp., which may be of importance in agriculture.

The compounds of the present invention may be administered orally or parenterally for animal and human usage, while they may be formulated in liquid or solid form for agricultural use. Oral administration may take the form of a unit dosage form such as a capsule, bolus or tablet, or as a liquid drench where used as an anthelmintic for animals.

The animal drench is normally a solution, suspension or dispersion of the active compound, usually in water, together with a suspending agent such as bentonite and a wetting agent or like excipient. Generally, the drenches also contain an antifoaming agent. Drench formulations generally contain about 0.001% to 0.5%, by weight, of the active compound. Preferred drench formulations contain about 0.01% to 0.1% by

weight.

Capsules and boluses comprise the active ingredient admixed with a carrier vehicle such as starch, talc, magnesium stearate or di-calcium phosphate.

Where it is desired to administer the 23-oxo or 23-imino derivatives of C(26,27)-epoxy or C(14,15; 26,27)-diepoxy-LL-F28249 in a dry, solid unit dosage form, capsules, boluses or tablets containing the desired amount of active compound usually are employed. These dosage forms are prepared by intimately and uniformly mixing the active ingredient with suitable finely divided diluents, fillers, disintegrating agents and/or binders such as starch, lactose, talc, magnesium stearate or vegetable gums. Such unit dosage formulations may be varied widely with respect to their total weight and content of the active compound depending upon factors such as the type of host animal to be treated, the severity and type of infection and the weight of the host.

When the active compound is to be administered via an animal feedstuff, it is intimately dispersed in the feed or used as a top dressing or in the form of pellets which may then be added to the finished feed or optionally fed separately. Alternatively, the active compounds of the present invention may be administered to animals parenterally, such as by intraruminal, intramuscular, intratracheal, or subcutaneous injection. In such an event, the active compound is dissolved or dispersed in a liquid carrier vehicle.

For parenteral administration, the active compound is suitably admixed with an acceptable vehicle, preferably of the vegetable oil variety such as peanut oil or cotton seed oil. Other parenteral vehicles such as organic preparations using solketal, propylene glycol, glycerol formal, and aqueous parenteral formulation also are used. The active 23-oxo or -imino compound or compounds of the present invention are dissolved or suspended in the parenteral formulation for administration. Such formulations generally contain about 0.005% to 5%, by weight, of the active compound.

Although the compounds of the present invention are primarily used in the treatment, prevention or control of helminthiasis, they also are useful in the prevention and treatment of diseases caused by other parasites. For example, arthropod parasites such as ticks, lice, fleas, mites and other biting insects in domesticated animals and poultry are controlled by the present compounds. These compounds also are effective in treatment of parasitic diseases that occur in other animals including human beings. The optimum amount to be employed will, of course, depend upon the particular compound employed, the species of animal to be treated and the type of severity of parasitic infection or infestation. Generally, the amount useful in oral administration of these novel compounds is about 0.001 mg to 10 mg per kg of animal body weight, such total dose being given at one time or in divided doses over a relatively short period of time (1-5 days). The preferred compounds of the invention give excellent control of such parasites in animals by administering about 0.025 mg to 3 mg per kg of animal body weight in a single dose. Repeat treatments are given as required to combat re-infections and are dependent upon the species of parasite and the husbandry techniques being employed. The techniques for administering these materials to animals are known to those skilled in the veterinary field.

When the compounds described herein are administered as a component of the animal's feed, or dissolved or suspended in the drinking water, compositions are provided in which the active compound or compounds are intimately dispersed in an inert carrier or diluent. An inert carrier is one that will not react with the active component and that will be administered safely to animals. Preferably, a carrier for feed administration is one that is, or may be, an ingredient of the animal ration.

Suitable compositions include feed premixes or supplements in which the active compound is present in relatively large amounts, wherein said feed premixes or supplements are suitable for direct feeding to the animal or for addition to the feed either directly or after an intermediate dilution or blending step.

Typical carriers or diluents suitable for such compositions include distillers' dried grains, corn meal, citrus meal, fermentation residues, ground oyster shells, wheat shorts, molasses solubles, corn cob meal, edible bean mill feed, soya grints or crushed limestone. The active compounds are intimately dispersed throughout the carrier by methods such as grinding, stirring, milling or tumbling. Compositions containing about 0.005% to 2.0%, by weight, of the active compound are particularly suitable as feed premixes.

Feed supplements, which are fed directly to the animal, contain about 0.0002% to 0.3%, by weight, of the active compounds. Such supplements are added to the animal feed in an amount to give the finished feed the concentration of active compound desired for the treatment, prevention and/or control of parasitic diseases. Although the desired concentration of active compound will vary depending upon the factors previously mentioned as well as upon the particular derivative employed, the compounds of this invention are usually fed at concentrations of about 0.00001% to 0.02% in the feed in order to achieve the desired antiparasitic result.

The compounds also may be administered by pouring on the skin of animals via a solution. Generally, the active compounds are dissolved in a suitable inert solvent, such as dimethylsulfoxide or propylene

glycol, alternatively in combination of solvents, for the pour-on administration.

The compounds of this invention also are useful in combating agricultural pests that inflict damage upon growing or stored crops. The present compounds are applied, using known techniques such as sprays, dusts or emulsions, to the growing or stored crops to effect protection from such agricultural pests.

The present invention is illustrated by the following examples which are illustrative of said invention.

* refers to the fact that the compounds are used in a method according to claim 11 and 16.

EXAMPLE 1

5,23-O,O-(Bis-tert-butyldimethylsilyl)-LL-F28249 α

In 20 mL of dimethylformamide, 2.0 g of LL-F28249 α , 3.72 g of t-butyldimethylsilyl chloride and 2.38 g of imidazole are heated at 60 °C in an oil bath under N₂ for 6 hours. The mixture is cooled, quenched with 5 mL of H₂O and diluted with 100 mL of H₂O and 50 mL of brine. The product is then extracted from the aqueous mixture with 2x50 mL of Et₂O. The combined Et₂O extracts are washed with 2x25 mL of H₂O, 10 mL of brine and dried over MgSO₄. Removal of Et₂O affords the title compound that is identified by mass spectrometry and NMR spectroscopy.

EXAMPLES 2 AND 3

LL-F28249 α -C(26,27)-Epoxide and LL-F28249 α -C(14,15;26,27)-Diepoxide

In 5 mL of CH₂Cl₂, 105.4 mg of 5,23-O,O-(bis-t-butyldimethylsilyl)-LL-F28249 α is dissolved and the solution is cooled in dry-ice/acetone bath, while 27.8 mg of m-chloroperoxybenzoic acid in 3 mL is slowly added dropwise. After an hour of stirring under N₂, the temperature is raised to -42 °C for 2 hours and -20 °C for an hour. The solution is washed with 1 mL of saturated Na₂SO₃ solution, 1 mL of saturated NaHCO₃ solution and 1 mL of brine. After drying over Na₂SO₄, the solution is evaporated, and the residue is chromatographed on silica gel in a flash chromatography apparatus using 5% EtOAc/hexane followed by 10% EtOAc/hexane. Fractions 16 to 20 afford 45 mg of monoepoxide while fractions 31-36 afford 12.1 mg of diepoxide.

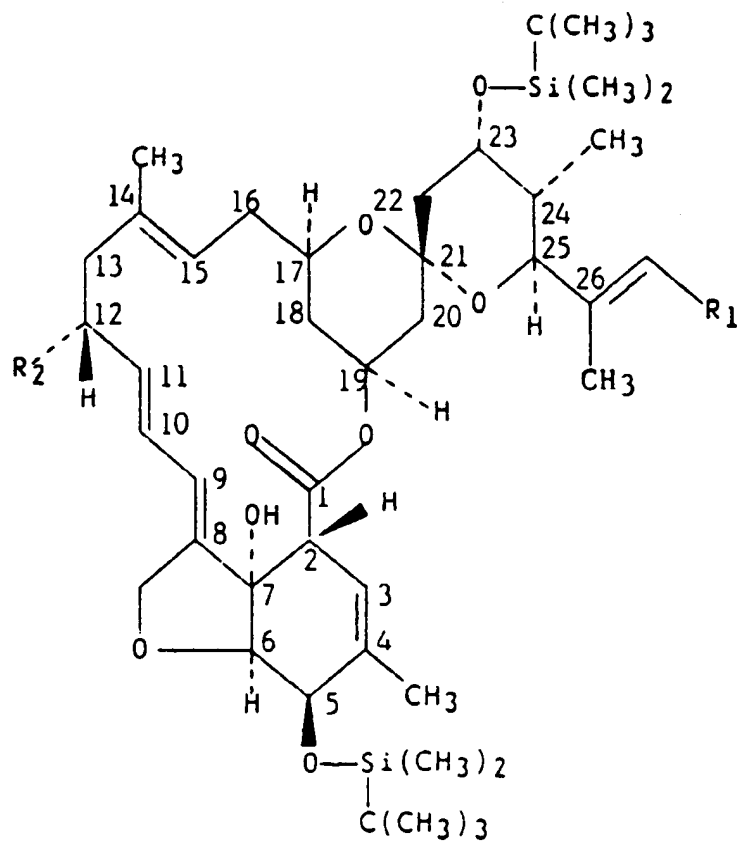
In 1 mL of MeOH, 30.3 mg of epoxide is stirred with 10.2 mg of p-toluenesulfonic acid monohydrate for 7.5 h under N₂. The mixture is diluted with 1 mL of saturated NaHCO₃ solution and 5 mL of H₂O and extracted with 3x2 mL of Et₂O. The combined Et₂O extracts are washed with brine, dried over MgSO₄, filtered and evaporated to dryness. The residue is chromatographed on silica gel using a flash chromatography apparatus and 2% isopropanol/CH₂Cl₂ as eluent to afford 9.4 mg of LL-F28249 α -C(26,27)-epoxide, which is identified by mass spectrometry and NMR spectroscopy.

Similarly, the diepoxide is treated with p-toluenesulfonic acid to afford deblocked LL-F28249 α -C-(14,15;26,27)-diepoxide.

EXAMPLES 4-7

5,23-O,O-(Bis-tert-butyldimethylsilyl)-LL-F28249 compounds

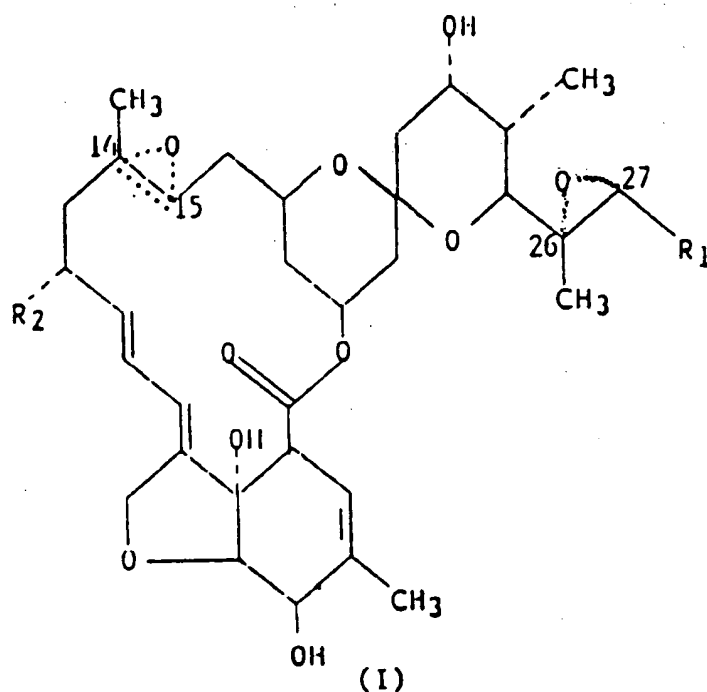
5 Using the procedure of Example 1, the following bis-silylated products are prepared:



R_1	R_2
$CH(CH_3)_2$	H
CH_2CH_3	CH_3
$CH(CH_3)_2$	CH_2CH_3
CH_3	CH_3

EXAMPLES 8-15**LL-F28249-C(26,27)-Epoxides and LL-F28249-C(14,15; 26,27)-Diepoxides**

Using the method of Example 2, the following epoxides and diepoxides of structure (I) are prepared:



R_1	R_2
$CH(CH_3)_2$	H
CH_2CH_3	CH_3
$CH(CH_3)_2$	CH_2CH_3
CH_3	CH_3

EXAMPLE 16**5-O-t-Butyldimethylsilyl-C(26,27)-epoxy-LL-F28249 α**

In 5 mL of CH_2Cl_2 , 285 mg of C(26,27)-epoxy-LL-F28249 α and 339 mg of imidazole are stirred in an ice bath and treated with 205 mg of t-butyldimethylsilyl chloride. The mixture is stirred at room temperature under N_2 atmosphere for 5 hours and diluted with an equal volume of ether. The mixture is then washed with H_2O and saturated NaCl solution, dried over $MgSO_4$ and evaporated to dryness. The glassy residue is purified by flash chromatography on silica gel using 1% isopropanol/heptane, followed by 2% isopropanol/heptane as eluent. Further purification by flash chromatography on silica gel using 100 mL of 10% EtOAc/heptane, followed by 100 mL of 20% EtOAc/heptane and evaporation of fractions from the latter elution affords the title compound, which is pure by high performance chromatography (HPLC), using 50% CH_3CN /50% H_2O in a curved gradient mode on a Whatman Partisil CCS/C $_8$ rapid analysis column at 1 mL/min. flowrate.

EXAMPLES 17-20

Using the method of Example 16, the following 5-O-t-butyldimethylsilyl-C(26,27)-epoxy-LL-F28249 compounds are prepared:

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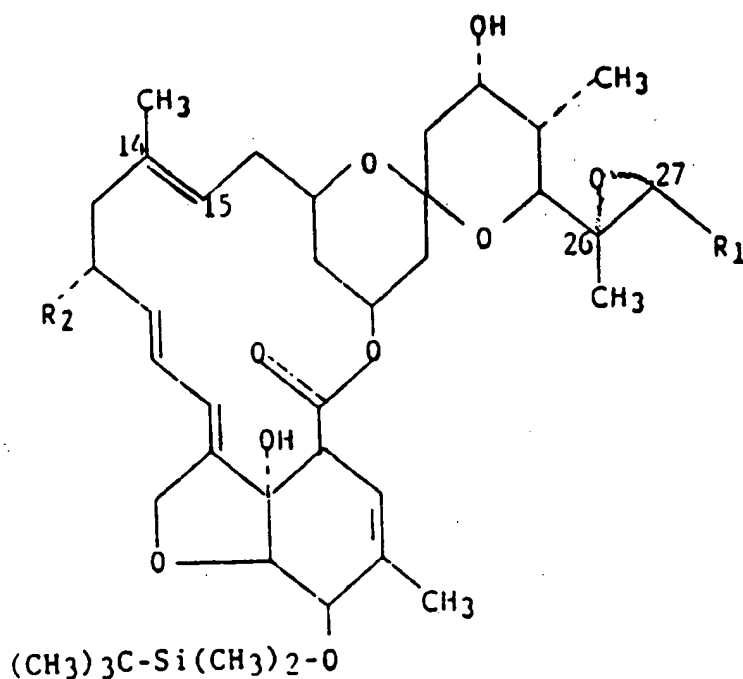
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<u>R₁</u>	<u>R₂</u>
CH(CH ₃) ₂	H
CH ₂ CH ₃	CH ₃
CH(CH ₃) ₂	CH ₂ CH ₃
CH ₃	CH ₃

EXAMPLE 21

C(26,27)-Epoxy-23-Oxo-LL-F28249 α

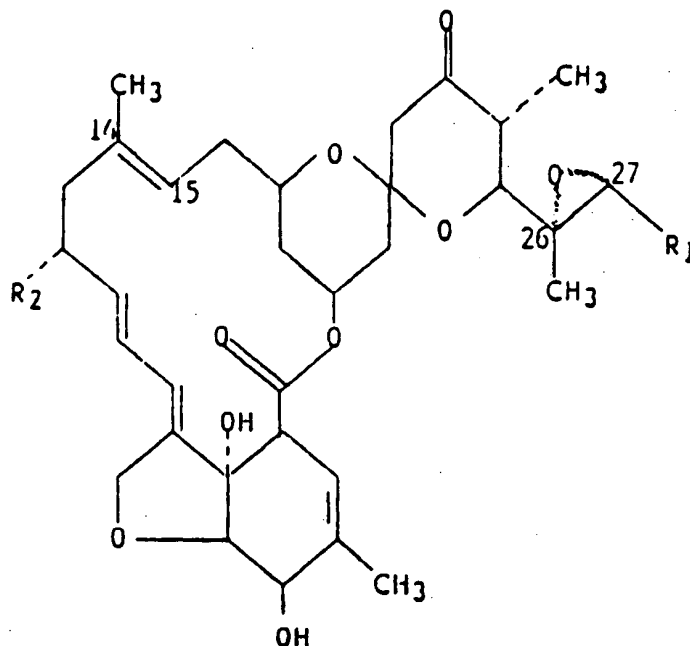
In 5 mL of dry CH₂Cl₂, 116 mg of 5-O-t-butyldimethylsilyl-C(26,27)-epoxy-LL-F28249 α is stirred, and 540 mg of NaOAc is added, followed by 173 mg of pyridinium chlorochromate (PCC). The reaction is followed by HPLC, and an additional 250 mg of PCC is added to complete the oxidation. After 6 hours, the mixture is poured into ice-water mixture, and the CH₂Cl₂ layer is separated. The aqueous layer is further extracted with 5 mL of CH₂Cl₂, and the combined CH₂Cl₂ extracts are washed with H₂O and dried over anhydrous Na₂SO₄. The CH₂Cl₂ solution is evaporated in vacuo to afford a glassy residue, which is dissolved in Et₂O. The Et₂O solution is filtered, dried over anhydrous Na₂SO₄ and evaporated to dryness to give a glassy residue. This residue is dissolved in 2 mL of MeOH and at 0°C treated with 30 mg of toluenesulfonic acid in 0.5 mL of MeOH. The mixture is stirred for 3 hours and poured into NaHCO₃ solution. After stirring, the mixture is extracted with EtOAc (5x4 mL) and the combined extracts are washed

with saturated NaCl solution, dried over anhydrous Na_2SO_4 and evaporated to dryness. The residue is purified by chromatography over SiO_2 using 10% isopropanol/ CH_2Cl_2 to afford the title compound, which is identified by mass spectrometry and NMR spectroscopy.

Substitution of PCC with pyridinium dichromate (PDC) in the above procedure also affords the title compound.

EXAMPLES 22-25

Using the procedure described in Example 21, the following C(26,27)-epoxy-23-oxo-LL-F28249 compounds are prepared:



R_1	R_2
$\text{CH}(\text{CH}_3)_2$	H
CH_2CH_3	CH_3
$\text{CH}(\text{CH}_3)_2$	CH_2CH_3
CH_3	CH_3

EXAMPLE 26

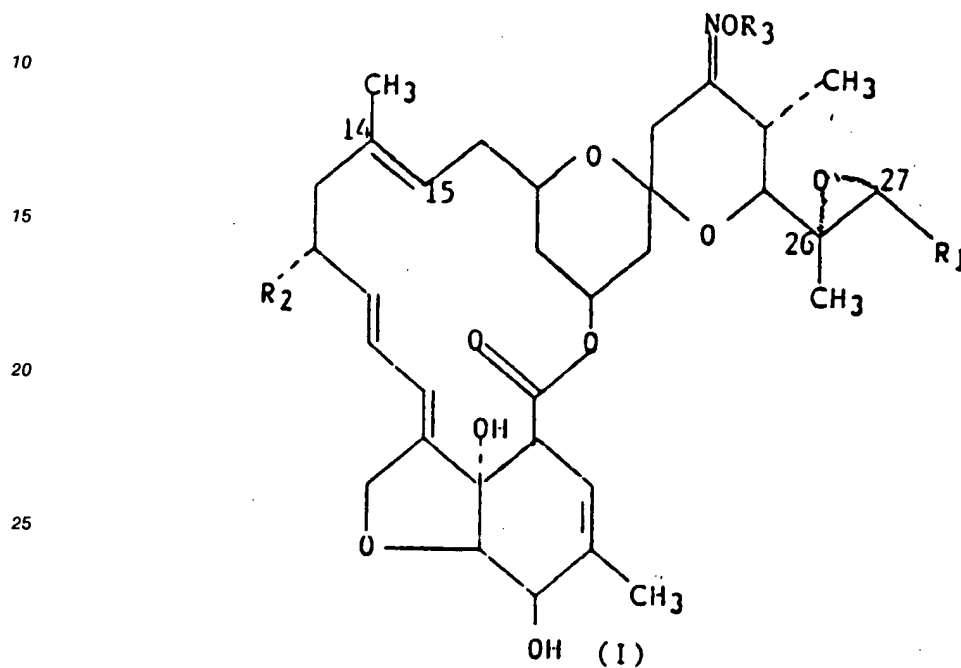
C(26,27)-epoxy-23-methoxime-LL-F28249 α

In 1 mL of dioxane, 70 mg of C(26,27)-epoxy-23-oxo-LL-F28749 α , 12 mg of NaOAc, 12 mg of $\text{CH}_3\text{ONH}_2 \cdot \text{HCl}$ and a drop of HOAc are stirred at room temperature until the reaction is complete by HPLC monitoring (3 days). The mixture is evaporated to near dryness and diluted with 5 mL of H_2O . The aqueous mixture is extracted with CH_2Cl_2 (4x2 mL) and the combined extracts are washed with H_2O , dried over anhydrous Na_2SO_4 and evaporated to dryness. The residue is dissolved in Et_2O (5 mL) and washed with H_2O (3x2 mL), dried over anhydrous Na_2SO_4 and evaporated to dryness to afford the title compound, which

is analyzed by mass spectrometry and NMR spectroscopy to confirm its structure.

EXAMPLES 27-38

- 5 Using the method of Example 26, the following C(26,27)-epoxide-23-substituted oximino-LLF28249 compounds are prepared using the appropriate $R_3ONH_2 \cdot HCl$:



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R_1	R_2	R_3
$CH(CH_3)_2$	H	CH_3
CH_2CH_3	CH_3	CH_3
$CH(CH_3)_2$	CH_2CH_3	CH_3
* CH_3	CH_3	CH_3
* $CH(CH_3)_2$	CH_3	C_2H_5
* $CH(CH_3)_2$	CH_3	$n-C_6H_{13}$
* $CH(CH_3)_2$	CH_3	H
* $CH(CH_3)_2$	CH_3	$i-C_3H_7$
$CH(CH_3)_2$	CH_3	C_6H_5
* $CH(CH_3)_2$	CH_3	Allyl
$CH(CH_3)_2$	CH_3	Pr pargyl
$CH(CH_3)_2$	CH_3	$C_2H_5OCOCH_2$

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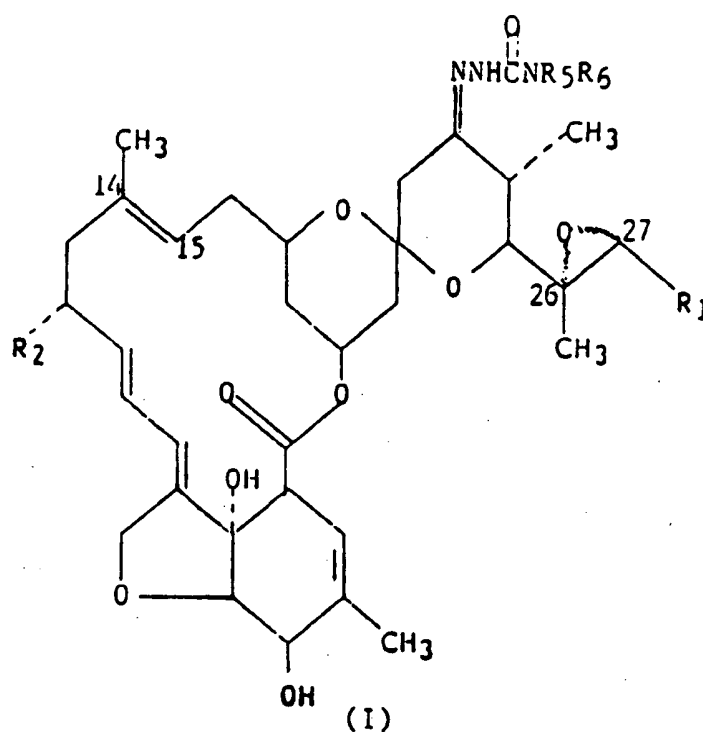
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EXAMPLE 39**C(26,27)-epoxy-23-semicarbazone-LL-F28249 α**

In 6 mL of dioxane, 60 mg of C(26,27)-epoxy-23-oxo-LL-F28249 α is stirred with 56.4 mg of NaOAc, 77 mg of semicarbazide hydrochloride and 18 μ L of HOAc for 7 days at room temperature. The mixture is poured on ice-H₂O mixture, and the composite is extracted with CH₂Cl₂ (3x15 mL). The combined extracts are washed with H₂O and evaporated to afford a glassy residue. The residue is dissolved in 50 mL of Et₂O and the Et₂O solution is washed with H₂O (8x20 mL), dried over anhydrous Na₂SO₄ and evaporated to afford the title compound, which is identified by mass spectrometry and NMR spectroscopy.

EXAMPLES 40-46

Using the method of Example 39, the following compounds are prepared by using the appropriate semicarbazide hydrochloride:



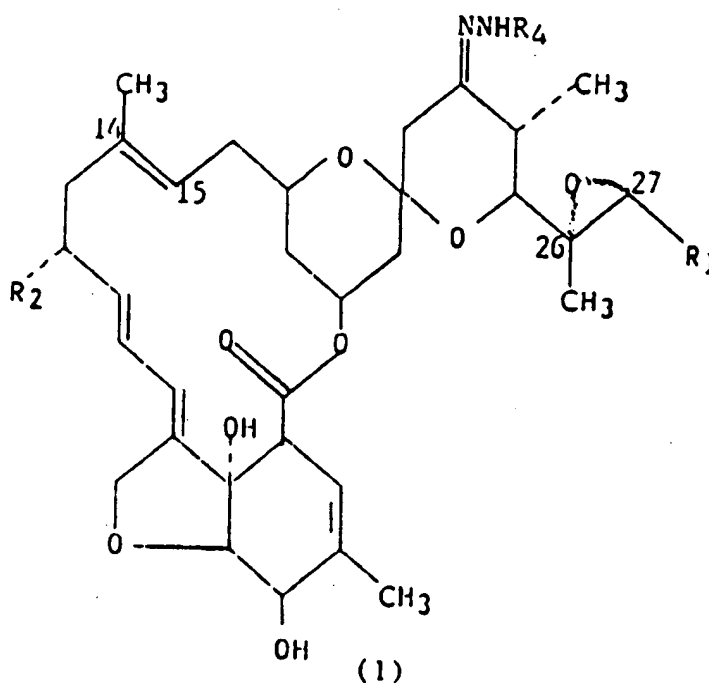
R_1	R_2	R_5	R_6
$CH(CH_3)_2$	H	H	H
CH_2CH_3	CH_3	H	H
$CH(CH_3)_2$	CH_2CH_3	H	H
CH_3	CH_3	H	H
$CH(CH_3)_2$	CH_3	H	CH_3
$CH(CH_3)_2$	CH_3	CH_3	CH_3
$CH(CH_3)_2$	CH_3	H	$n-C_4H_9$

EXAMPLE 47C(26,27)-epoxy-23-(2-formylhydrazone)-LL-F28249 α

In 20 mL of MeOH, 50 mg of C(26,27)-epoxy-23-oxo-LL-F28249 α is stirred with 25 mg of formylhydrazide in the presence of 10 μ l of HOAc. The mixture is stirred for 3 days and poured on ice. The aqueous portion is saturated with NaCl. The H₂O mixture is extracted with CH₂Cl₂ (3x10 mL), and the extracts are dried over Na₂SO₄ and evaporated to dryness to afford the title compound, which is identified by mass spectrometry and NMR spectroscopy.

EXAMPLES 48-57

Using the procedure of Example 47, the following 23-(substituted hydrazones) are prepared by using the appropriate substituted hydrazine:



	<u>R₁</u>	<u>R₂</u>	<u>R₄</u>
5	CH(CH ₃) ₂	H	CHO
	CH ₂ CH ₃	CH ₃	CHO
	CH(CH ₃) ₂	CH ₂ CH ₃	CHO
	CH ₃	CH ₃	CHO
10	CH(CH ₃) ₂	CH ₃	CH ₃ CO
	CH(CH ₃) ₂	CH ₃	C ₃ H ₇ CO
15	CH(CH ₃) ₂	CH ₃	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3\text{OC}- \end{array}$
20	CH(CH ₃) ₂	CH ₃	$\begin{array}{c} \text{O} \\ \parallel \\ \text{C}_2\text{H}_5\text{OC}- \end{array}$
25	CH(CH ₃) ₂	CH ₃	$\begin{array}{c} \text{O} \\ \parallel \\ \text{C}_4\text{H}_9\text{OC}- \end{array}$
	CH(CH ₃) ₂	CH ₃	C ₂ H ₅ CO

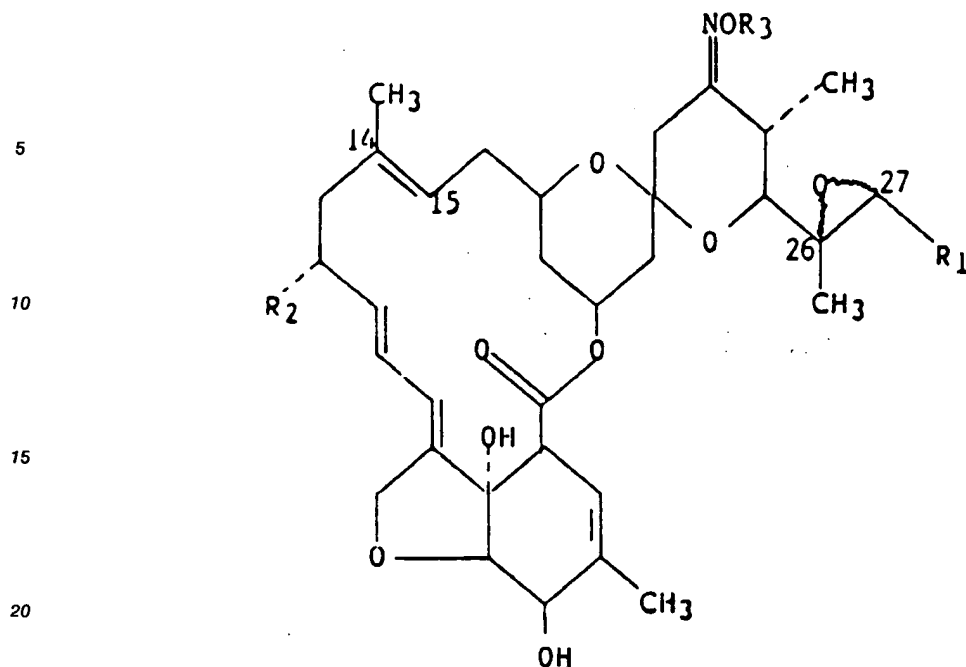
EXAMPLE 58

C(26,27)-epoxy-23-[O-(methylcarbamoyl)oxime]-LL-F28249 α

In 5 mL of Et₂O, 25 mg of C(26,27)-epoxy-23-oxime-LL-F28249 α as stirred under N₂ with 10 μ l of Et₃N and 50 μ l of methyl isocyanate for 18 hours at room temperature. The mixture is evaporated to dryness and the residue is purified on preparative chromatography plate (SiO₂) using 10% MeOH/ CH₂Cl₂ to afford the title compound which is identified by mass spectrometry and NMR spectroscopy.

EXAMPLES 59-70

Using the procedure of Example 59, the following compounds are prepared by using appropriate oximes and isocyanates.



R_1	R_2	R_3
$CH(CH_3)_2$	H	CH_3NHCO
CH_2CH_3	CH_3	CH_3NHCO
$CH(CH_3)_2$	CH_2H_3	CH_3NHCO
CH_3	CH_3	CH_3NHCO
$CH(CH_3)_2$	CH_3	C_2H_5NHCO
$CH(CH_3)_2$	CH_3	$1-C_3H_7NHCO$
$CH(CH_3)_2$	CH_3	$n-C_4H_9NHCO$
$CH(CH_3)_2$	CH_3	$CH_2=CHCH_2NHCO$
$CH(CH_3)_2$	CH_3	$HC=CCH_2NHCO$
$CH(CH_3)_2$	CH_3	$C_6H_5CH_2NHCO$
$CH(CH_3)_2$	CH_3	$4-ClC_6H_4NHCO$
$CH(CH_3)_2$	CH_3	$3,4-Cl_2C_6H_3NHCO$

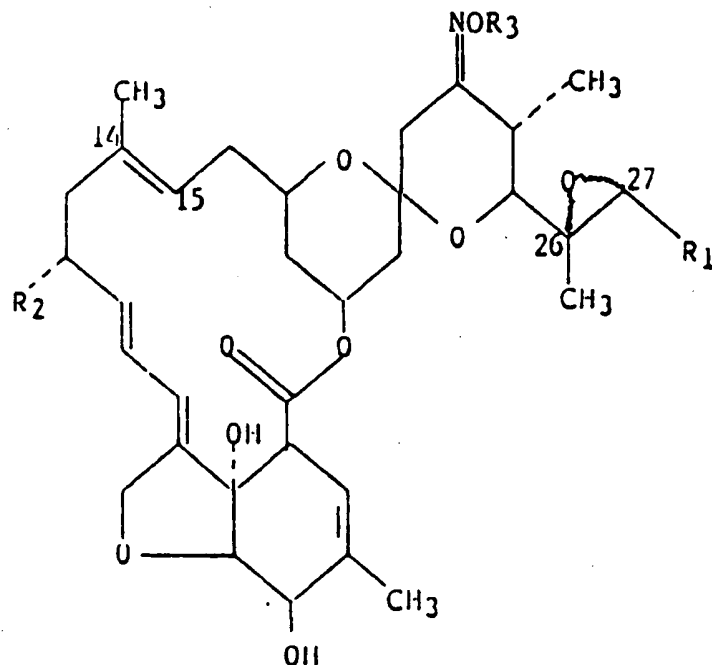
EXAMPLE 71

C(26,27)-epoxy-23-[O-(acetyl)oxime]-LL-F28249 α

In 1 mL of CH_2Cl_2 , 64 mg of C(26,27)-epoxy-23-oxime-LL-F28249 α is stirred at 0°C with 6 μ L of triethylamine and 5 mL of a solution containing 244.2 mg of Ac_2O in 100 mL of CH_2Cl_2 is added. The mixture is stirred at 0°C for 24 hours and evaporated to dryness to afford the title compound.

EXAMPLES 72-80

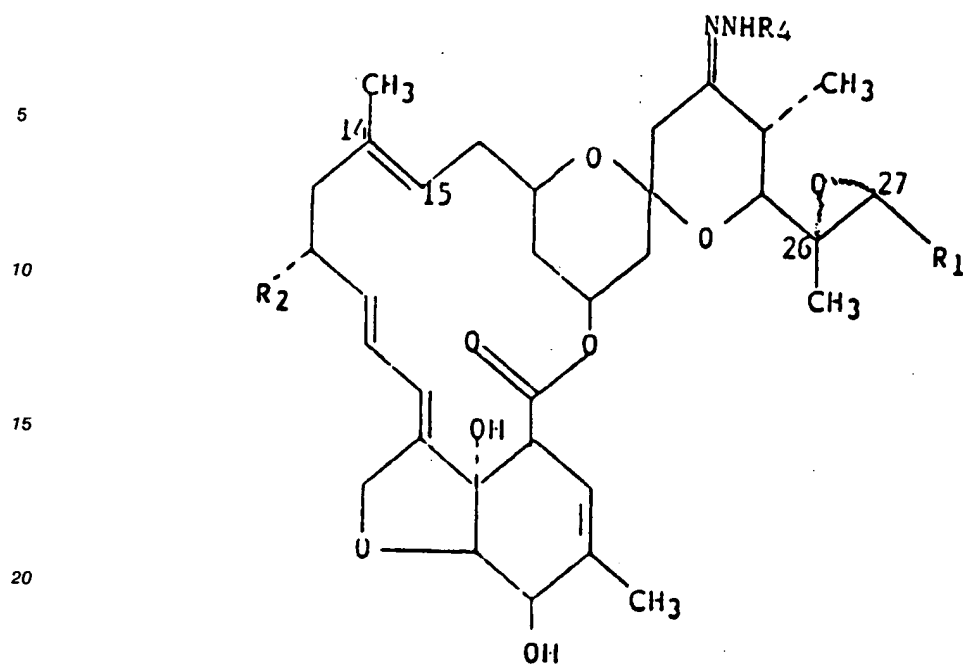
Using the procedure of Example 71, the following compounds are prepared by reacting the appropriate oximes and acid anhydrides:



R_1	R_2	R_3
$CH(CH_3)_2$	H	CH_3CO
CH_2CH_3	CH_3	CH_3CO
$CH(CH_3)_2$	CH_2CH_3	CH_3CO
CH_3	CH_3	CH_3CO
$CH(CH_3)_2$	CH_3	CH_3OCH_2CO
$CH(CH_3)_2$	CH_3	$ClCH_2CO$
$CH(CH_3)_2$	CH_3	$C_6H_5CH_2CO$
$CH(CH_3)_2$	CH_3	C_6H_5CO
$CH(CH_3)_2$	CH_3	4-Chlorobenzoyl

EXAMPLES 81-87

Using the procedure of Example 47, the following compounds are prepared by reacting the appropriate substituted hydrazines and 23-oxo compounds:



R_1	R_2	R_4
$CH(CH_3)_2$	H	CH_3
CH_2CH_3	CH_3	CH_3
$CH(CH_3)_2$	CH_2CH_3	CH_3
CH_3	CH_3	CH_3
$CH(CH_3)_2$	CH_3	CH_3
$CH(CH_3)_2$	CH_3	CH_2CH_3
$CH(CH_3)_2$	CH_3	$t-C_4H_9$

EXAMPLE 88

45 5-0-t-butylidimethylsilyl-C(14,15;26,27)-diepoxy-LL-F28249 α

Using the procedure of Example 16, the title compound is prepared.

EXAMPLE 89

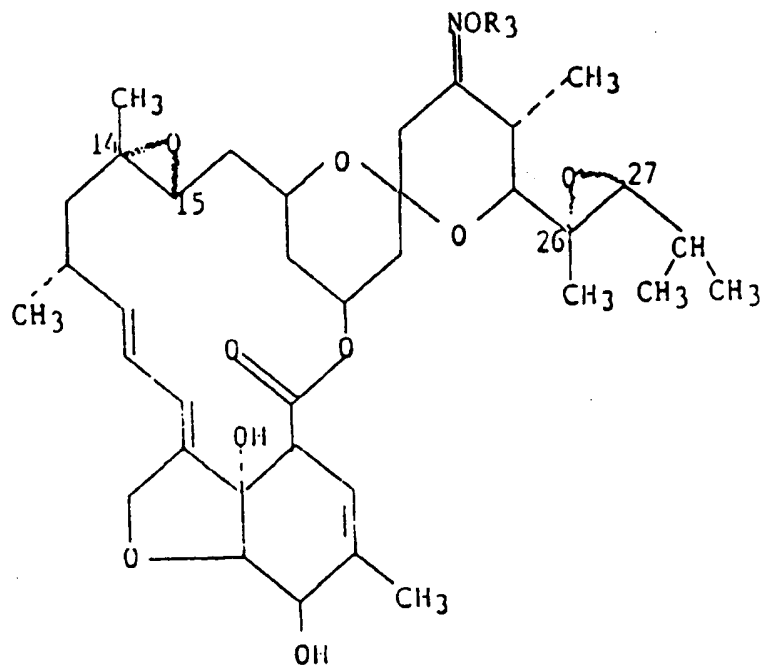
50 C(14,15;26,27)-diepoxy-23-oxo-LL-F28249 α

Using the method of Example 21, the title compound is prepared and identified by mass spectrometry and NMR spectroscopy.

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EXAMPLES 90-95

Using the method of Example 26, the following compounds are prepared:



R₃

*CH₃

*C₂H₅

*i-C₃H₇

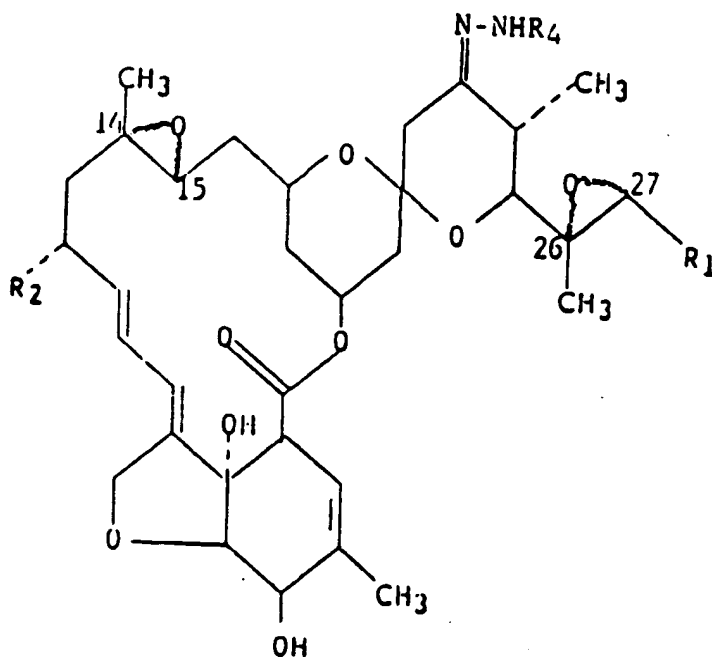
*n-C₆H₁₃

*Allyl

Propargyl

EXAMPLES 96-104

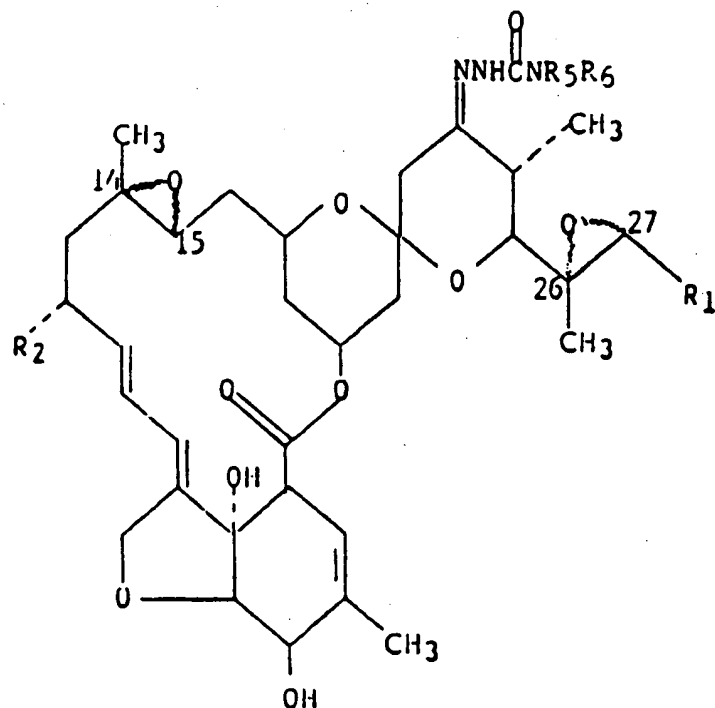
Using the method of Example 47, the following compounds are prepared:



<u>R₁</u>	<u>R₂</u>	<u>R₄</u>
CH(CH ₃) ₂	H	CHO
CH ₂ CH ₃	CH ₃	CHO
CH(CH ₃) ₂	CH ₂ CH ₃	CHO
CH ₃	CH ₃	CHO
CH(CH ₃) ₂	CH ₃	CHO
CH(CH ₃) ₂	CH ₃	C ₃ H ₇ CO
CH(CH ₃) ₂	CH ₃	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3\text{OC}- \end{array}$
CH(CH ₃) ₂	CH ₃	$\begin{array}{c} \text{O} \\ \parallel \\ \text{C}_2\text{H}_5\text{OC}- \end{array}$
CH(CH ₃) ₂	CH ₃	$\begin{array}{c} \text{O} \\ \parallel \\ \text{C}_2\text{H}_5\text{C}- \end{array}$

EXAMPLES 105-111

Using the method of Example 39, the following compounds are prepared by using the appropriate semicarbazide hydrochloride:



R_1	R_2	R_5	R_6
$CH(CH_3)_2$	H	H	H
CH_2CH_3	CH_3	H	H
$CH(CH_3)_2$	CH_2CH_3	H	H
CH_3	CH_3	H	H
$CH(CH_3)_2$	CH_3	H	CH_3
$CH(CH_3)_2$	CH_3	CH_3	CH_3
$CH(CH_3)_2$	CH_3	H	$n-C_4H_9$

Claims

Claims for the following Contracting States : AT, BE, CH, DE, FR, GB, IT, LI, LU, NL, SE

1. A compound represented by structural formula (I):

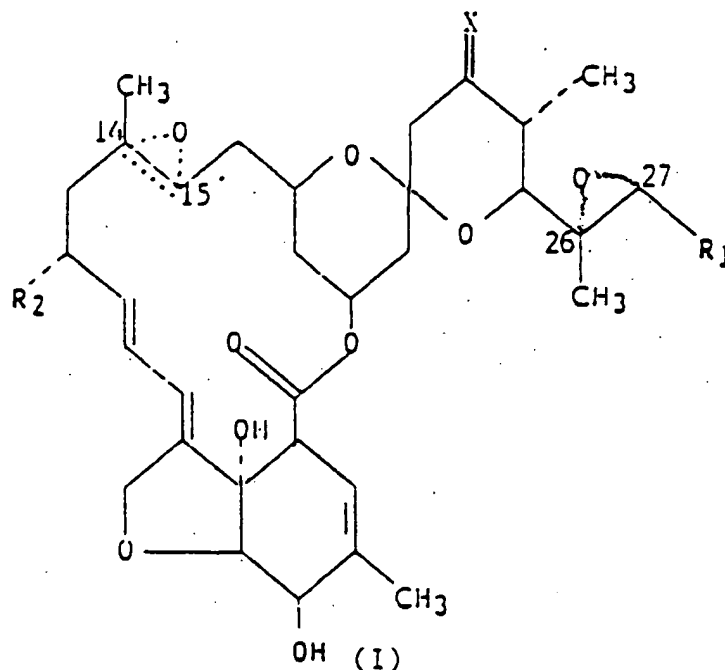
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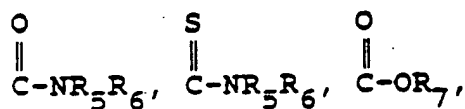


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wherein R₁ is methyl or isopropyl; R₂ is hydrogen, methyl or ethyl; X is oxygen, NOR₃, or N-NHR₄; R₃ is hydrogen, C₁-C₆ alkyl, benzyl, allyl, propargyl, phenyl, CH₂COO-alkyl (C₁-C₄), N-(C₁-C₆ alkyl)-carbamoyl, N-(allyl)carbamoyl, N-(propargyl)carbamoyl, N-(phenyl)-carbamoyl, N-(chlorophenyl)-carbamoyl, N-(dichlorophenyl)carbamoyl, N-(benzyl)carbamoyl, C₁-C₆ alkanoyl, chloroacetyl, methoxyacetyl, phenylacetyl, benzoyl and chlorobenzoyl; R₄ is

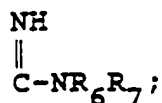
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C₁-C₄ alkanoyl, C₁-C₄ alkyl, or

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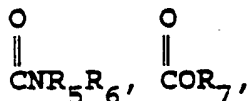


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R₅ and R₆ are hydrogen or C₁-C₄ alkyl; and R₇ is C₁-C₄ alkyl; and the dotted triangular figure with oxygen at C(14,15) indicates that either a double bond or an epoxide is present, with the proviso that when an epoxide or a double bond is present at C(14, 15) and both of R₁, R₂ are methyl or R₁ is isopropyl and R₂ is methyl, X cannot be oxygen or NOR₃ with R₃ representing hydrogen, C₁-C₆ alkyl or allyl.

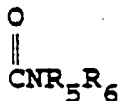
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2. The compound according to Claim 1, wherein, R₁ is isopropyl; R₂ is methyl; X is oxygen, NOR₃ or NNHR₄; and R₄ is



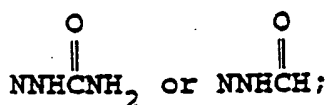
C₁-C₄ alkanoyl or C₁-C₄ alkyl, with the proviso of Claim 1.

3. The compound according to Claim 2, wherein, R₁ is isopropyl; R₂ is methyl; X is oxygen, NOR₃ or NNHR₄; R₄ is



or C₁-C₄ alkanoyl; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

4. The compound according to Claim 1, wherein R₁ is isopropyl; R₂ is methyl; X is oxygen, NOCH₃,

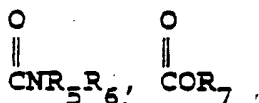


and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

5. The compound according to Claim 4, wherein, R₁ is isopropyl; R₂ is methyl; X is NOCH₃; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

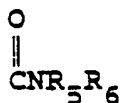
6. A compound according to Claim 1 for use in the prevention, treatment or control of endoparasitic or ectoparasitic infections in warm-blooded animals.

7. A compound for the use according to Claim 6, wherein the compound is R₁ as isopropyl; R₂ as methyl; X is oxygen, NOR₃, N-NHR₄, and R₄ is



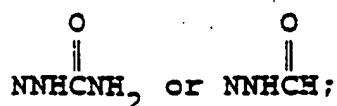
C₁-C₄ alkanoyl or C₁-C₄ alkyl, with the proviso of Claim 1.

8. The compound according to Claim 7, wherein said compound is R₁ as isopropyl; R₂ is methyl; X is oxygen, NOR₃ or NNHR₄; R₄ is



or C₁-C₄ alkanoyl; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

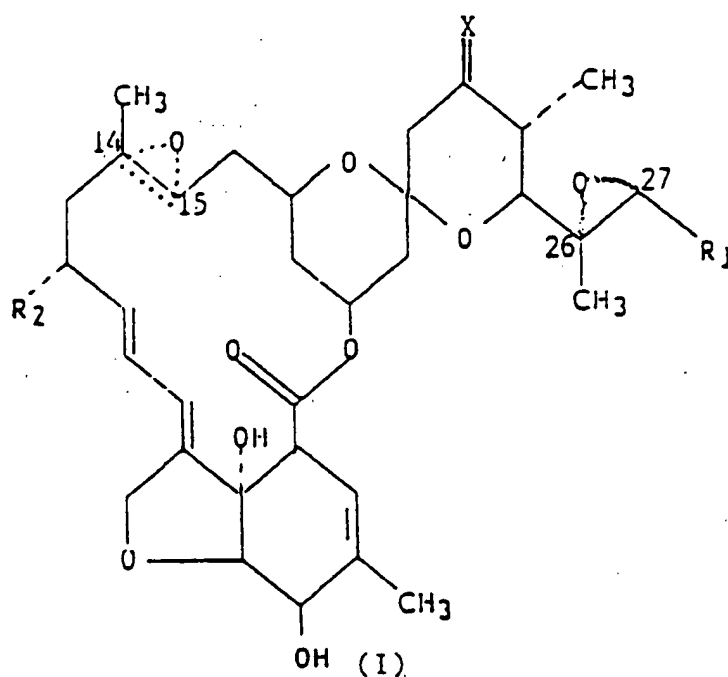
9. The compound according to Claim 6, wherein said compound is R₁ as isopropyl; R₂ is methyl; X is oxygen, NOCH₃,



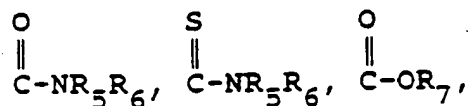
and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

10. The compound according to Claim 9, wherein, R₁ is isopropyl; R₂ is methyl; X is NOCH₃; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

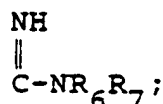
11. A method for controlling plant insects topically or systemically, and protecting crops, trees, shrubs, stored grain and ornamental plants, said method comprising applying to the growing or stored crops an effective amount of a compound represented by structural formula (I),



wherein R₁ is methyl or isopropyl; R₂ is hydrogen, methyl or hydrogen; X is oxygen, NOR₃, or N-NHR₄; R₃ is hydrogen, C₁-C₆ alkyl, benzyl, allyl, propargyl, phenyl, CH₂COO-alkyl (C₁-C₄), N-(C₁-C₆ alkyl)carbamoyl, N-(allyl)carbamoyl, N-(propargyl)carbamoyl, N-(phenyl)carbamoyl, N-(chlorophenyl)carbamoyl, N-(dichlorophenyl)carbamoyl, N-(benzyl)carbamoyl, C₁-C₆ alkanoyl, chloroacetyl, methoxyacetyl, phenylacetyl, benzoyl and chlorobenzoyl; R₄ is

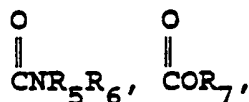


C₁-C₄ alkanoyl, C₁-C₄ alkyl, or



R₅ and R₆ are hydrogen or C₁-C₄ alkyl; and R₇ is C₁-C₄ alkyl; and the dotted triangular figure with oxygen at C(14,15) indicates that either a double bond or an epoxide is present.

12. A method according to Claim 11, wherein said compound is R₁ as isopropyl; R₂ as methyl; X is oxygen, NOR₃, N-NHR₄, and R₄ is



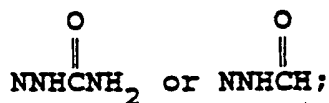
C₁-C₄ alkanoyl or C₁-C₄ alkyl.

13. The method according to Claim 12, wherein said compound is R₁ as isopropyl; R₂ is methyl; X is oxygen, NOR₃ or NNHR₄; R₄ is



or C₁-C₄ alkanoyl; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

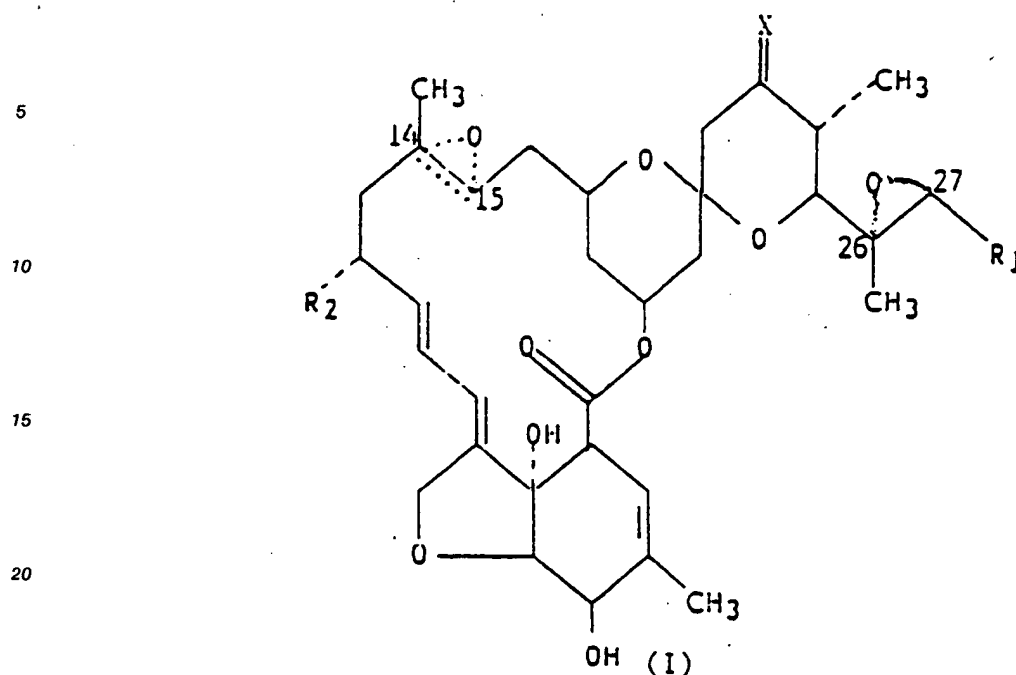
14. The method according to Claim 11, wherein said compound is R₁ as isopropyl; R₂ is methyl; X is oxygen, NOCH₃,



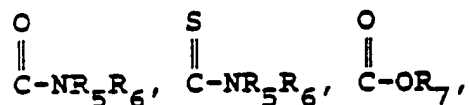
and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

15. The method according to Claim 14, wherein, R₁ is isopropyl; R₂ is methyl; X is NOCH₃; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

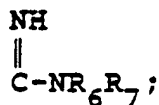
16. A method for the control of plant nematodes, said method comprising: applying to the foliage of plants, the soil in which they are grown or into the trunks thereof, a nematicidally-effective amount of the compound represented by structural formula (I),



wherein R_1 is methyl or isopropyl; R_2 is hydrogen, methyl or ethyl; X is oxygen, NOR_3 , or $N-NHR_4$; R_3 is hydrogen, C_1 - C_6 alkyl, benzyl, allyl, propargyl, phenyl, CH_2COO -alkyl (C_1 - C_4), N -(C_1 - C_6 alkyl)-carbamoyl, N -(allyl)carbamoyl, N -(propargyl)carbamoyl, N -(phenyl)carbamoyl, N -(chlorophenyl)-carbamoyl, N -(dichlorophenyl)carbamoyl, N -(benzyl)carbamoyl, C_1 - C_6 alkanoyl, chloroacetyl, methoxyacetyl, phenylacetyl, benzoyl and chlorobenzoyl; R_4 is

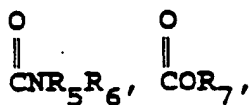


C_1 - C_4 alkanoyl, C_1 - C_4 alkyl, or



R_5 and R_6 are hydrogen or C_1 - C_4 alkyl; and R_7 is C_1 - C_4 alkyl; and the dotted triangular figure with oxygen at C(14,15) indicates that either a double bond or an epoxide is present.

17. A method according to Claim 16, wherein said compound is R_1 as isopropyl; R_2 as methyl; X is oxygen, NOR_3 , $N-NHR_4$, and R_4 is



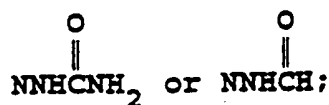
C_1 - C_4 alkanoyl or C_1 - C_4 alkyl.

18. The method according to claim 17, wherein said compound is R_1 as isopropyl; R_2 is methyl; X is oxygen, NOR_3 or $NNHR_4$; R_4 is



or C_1 - C_4 alkanoyl; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

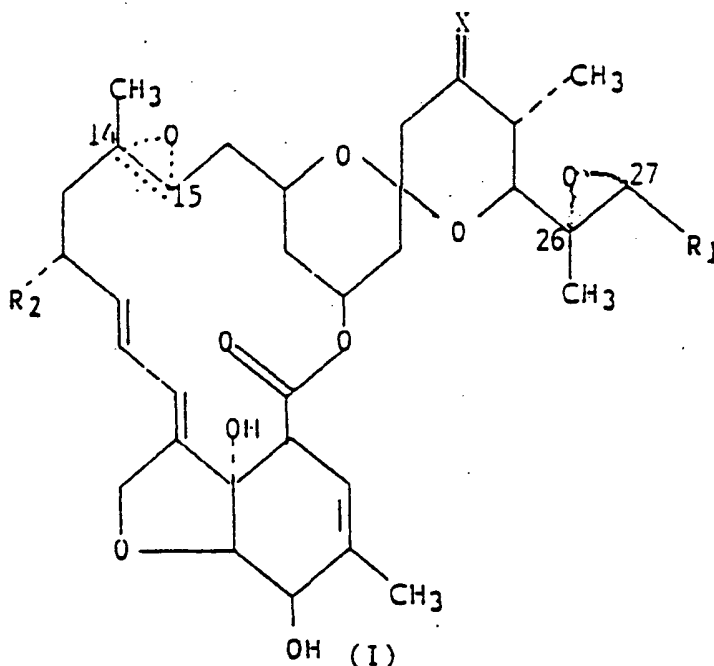
19. The method according to Claim 16, wherein said compound is R_1 as isopropyl; R_2 is methyl; X is oxygen, $NOCH_3$,



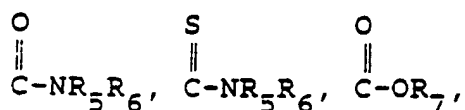
and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

20. The method according to Claim 19, wherein, R_1 is isopropyl; R_2 is methyl; X is $NOCH_3$; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

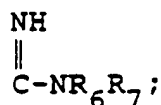
21. A composition for the treatment, prevention or control of endo- and/or ectoparasitic infections in warm-blooded animals, said composition comprising: a prophylactically, therapeutically or pharmaceutically-effective amount of the compound represented by structural formula (I),



wherein R_1 is methyl or isopropyl; R_2 is hydrogen, methyl or ethyl; X is oxygen, NOR_3 , or $N-NHR_4$; R_3 is hydrogen, C_1 - C_6 alkyl, benzyl, allyl, propargyl, phenyl, CH_2COO -alkyl (C_1 - C_4), N -(C_1 - C_6 alkyl)-carbamoyl, N -(allyl)carbamoyl, N -(propargyl)carbamoyl, N -(phenyl)carbamoyl, N -(chlorophenyl)-carbamoyl, N -(dichlorophenyl)carbamoyl, N -(benzyl)carbamoyl, C_1 - C_6 alkanoyl, chloroacetyl, methoxyacetyl, phenylacetyl, benzoyl and chlorobenzoyl; R_4 is

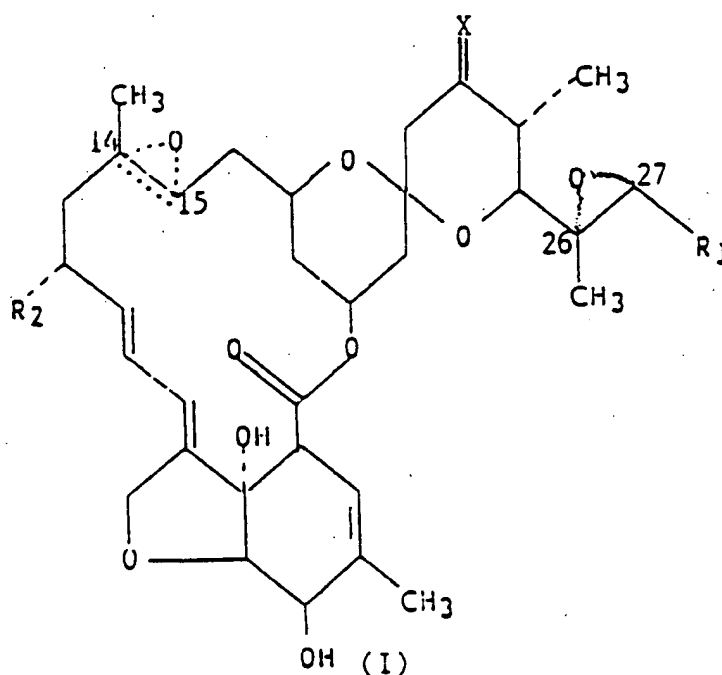


C₁-C₄ alkanoyl, C₁-C₄ alkyl, or

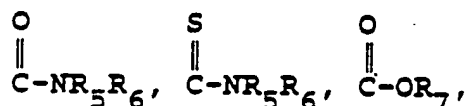


R₅ and R₆ are hydrogen or C₁-C₄ alkyl; and R₇ is C₁-C₄ alkyl; and the dotted triangular figure with oxygen at C(14,15) indicates that either a double bond or an epoxide is present with the proviso of claim 1; and an inert carrier.

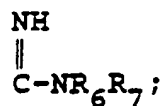
22. A composition for controlling insects, said composition comprising: an insecticidally-effective amount of the compound represented by the structural formula (I),



wherein R₁ is methyl or isopropyl; R₂ is hydrogen, methyl or ethyl; X is oxygen, NOR₃, or N-NHR₄; R₃ is hydrogen, C₁-C₆ alkyl, benzyl, allyl, propargyl, phenyl, CH₂COO-alkyl (C₁-C₄), N-(C₁-C₆ alkyl)-carbamoyl, N-(allyl)carbamoyl, N-(propargyl)carbamoyl, N-(phenyl)carbamoyl, N-(chlorophenyl)-carbamoyl, N-(dichlorophenyl)carbamoyl, N-(benzyl)carbamoyl, C₁-C₆ alkanoyl, chloroacetyl, methoxyacetyl, phenylacetyl, benzoyl and chlorobenzoyl; R₄ is



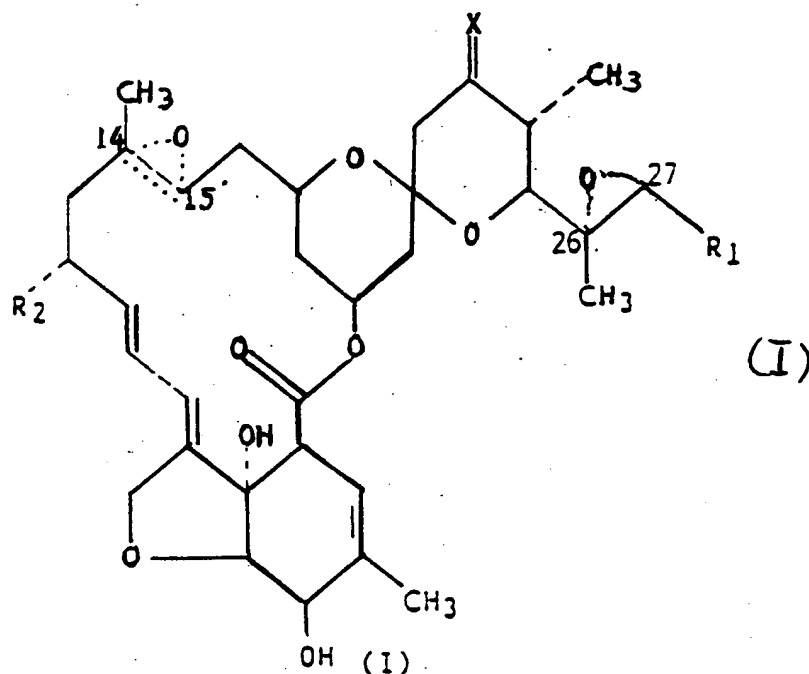
C₁-C₄ alkanoyl, C₁-C₄ alkyl, or



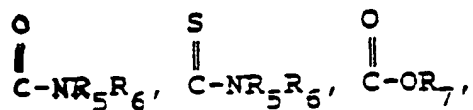
R_5 and R_6 are hydrogen or C_1 - C_4 alkyl; and R_7 is C_1 - C_4 alkyl; and the dotted triangular figure with oxygen at C(14,15) indicates that either a double bond or an epoxide is present with the proviso of claim 1; and an inert carrier.

Claims for the following Contracting States : ES, GR

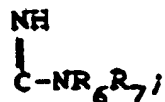
1. A process for preparing a compound represented by the structural formula (I)



wherein R_1 is methyl or isopropyl; R_2 is hydrogen, methyl or ethyl; X is oxygen, NOR_3 , or N-NHR_4 ; R_3 is hydrogen, C_1 - C_6 alkyl, benzyl, allyl, propargyl, phenyl, CH_2COO -alkyl (C_1 - C_4), N-(C_1 - C_6 alkyl)-carbamoyl, $\text{N-(allyl)carbamoyl}$, $\text{N-(propargyl)carbamoyl}$, $\text{N-(phenyl)carbamoyl}$, $\text{N-(chlorophenyl)carbamoyl}$, $\text{N-(dichlorophenyl)carbamoyl}$, $\text{N-(benzyl)carbamoyl}$, C_1 - C_6 alkanoyl, chloroacetyl, methoxyacetyl, phenylacetyl, benzoyl and chlorobenzoyl; R_4 is



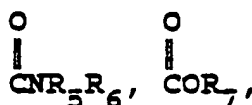
C_1 - C_4 alkanoyl, C_1 - C_4 alkyl, or



R_5 and R_6 are hydrogen or C_1 - C_4 alkyl; and R_7 is C_1 - C_4 alkyl; and the dotted triangular figure with oxygen at C(14,15) indicates that either a double bond or an epoxide is present, with the proviso that when an epoxide or a double bond is present at C(14,15) and both of R_1 , R_2 are methyl or R_1 is isopropyl and R_2 is methyl, X cannot be oxygen or NOR_3 with R_3 representing hydrogen, C_1 - C_6 alkyl or allyl, said process comprising the following steps:

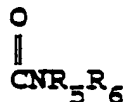
- treating a protected LL-F28249 compound with a mild oxidizing agent capable of selectively oxidizing the C(26,27) double bond as well as the C(14,15) double bond but leaving other double bonds in the molecule intact to prepare the corresponding C(26,27)-epoxy or the C(14,15;26,27)-diepoxy-LL-F28249 compound, in an inert solvent at temperatures less than -15°C ,
- removing the protecting groups at the 5- and 23-hydroxy groups,
- protecting the 5-hydroxy group and subjecting the 23-hydroxyl group of the protected C(26,27)-epoxy- or C(14,15,26,27)-diepoxy-LL-F28249 compound to an oxidation to obtain the corresponding 23-oxo derivative, and
- removing the protecting group to obtain the desired 23-keto-C(26,27)-epoxy- or C(14,15;26,27)-diepoxy-LL-F28249 compound of formula (I) wherein $X=O$ and, optionally, converting the 23-oxo compound to a derivative of formula (I) wherein $X=NOR_3$ or $N-NHR_4$, wherein R_3 and R_4 are as defined above, in a manner shown

2. The process according to Claim 1, wherein, R_1 is isopropyl; R_2 is methyl; X is oxygen, NOR_3 or $NNHR_4$; and R_4 is



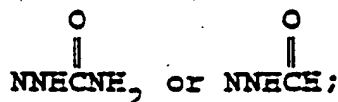
C_1 - C_4 alkanoyl or C_1 - C_4 alkyl, with the proviso of Claim 1.

3. The process according to Claim 2, wherein, R_1 is isopropyl; R_2 is methyl; X is oxygen, NOR_3 or $NNHR_4$; R_4 is



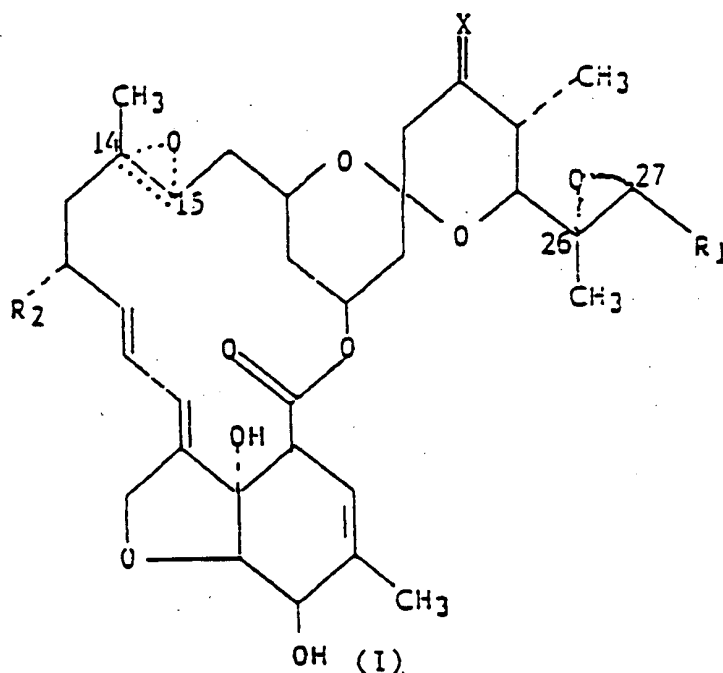
or C_1 - C_4 alkanoyl; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

4. The process according to Claim 1, wherein R_1 is isopropyl; R_2 is methyl; X is oxygen, $NOCH_3$,

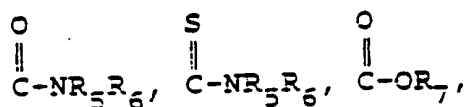


and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

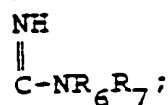
5. The process according to Claim 4, wherein, R_1 is isopropyl; R_2 is methyl; X is $NOCH_3$; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.
6. A process for controlling plant insects topically or systemically, and protecting crops, trees, shrubs, stored grain and ornamental plants, said method comprising applying to the growing or stored crops an effective amount of a compound represented by structural formula (I),



wherein R_1 is methyl or isopropyl; R_2 is hydrogen, methyl or hydrogen; X is oxygen, NOR_3 , or $N-NHR_4$; R_3 is hydrogen, C_1 - C_6 alkyl, benzyl, allyl, propargyl, phenyl, CH_2COO -alkyl (C_1 - C_4), N -(C_1 - C_6 alkyl)carbamoyl, N -(allyl)carbamoyl, N -(propargyl)carbamoyl, N -(phenyl)carbamoyl, N -(chlorophenyl)carbamoyl, N -(dichlorophenyl)carbamoyl, N -(benzyl)carbamoyl, C_1 - C_6 alkanoyl, chloroacetyl, methoxyacetyl, phenylacetyl, benzoyl and chlorobenzoyl; R_4 is

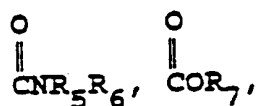


C_1 - C_4 alkanoyl, C_1 - C_4 alkyl, or



R_5 and R_6 are hydrogen or C_1 - C_4 alkyl; and R_7 is C_1 - C_4 alkyl; and the dotted triangular figure with oxygen at C(14,15) indicates that either a double bond or an epoxide is present.

7. A process according to Claim 6 wherein said compound is R_1 as isopropyl; R_2 as methyl; X is oxygen, NOR_3 , $N-NHR_4$, and R_4 is



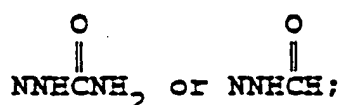
C_1 - C_4 alkanoyl or C_1 - C_4 alkyl.

8. The process according to Claim 7, wherein said compound is R_1 as isopropyl; R_2 is methyl; X is oxygen, NOR_3 or $NNHR_4$; R_4 is



or C_1 - C_4 alkanoyl; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

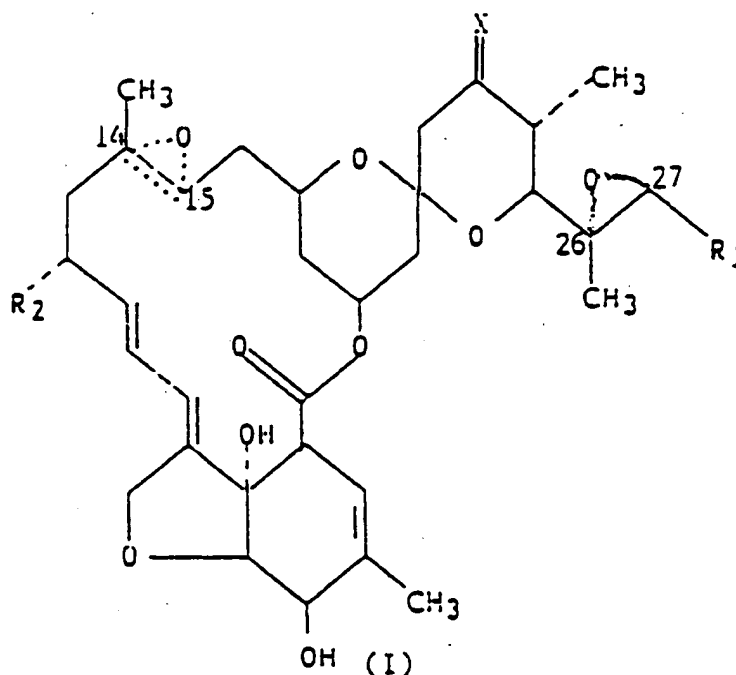
9. The process according to Claim 6, wherein said compound is R_1 as isopropyl; R_2 is methyl; X is oxygen, $NOCH_3$,



and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

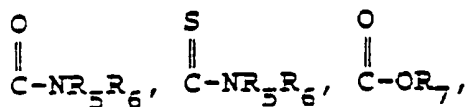
10. The process according to Claim 9, wherein, R_1 is isopropyl; R_2 is methyl; X is $NOCH_3$; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

11. A process for the control of plant nematodes, said method comprising: applying to the foliage of plants, the soil in which they are grown or into the trunks thereof, a nematocidally-effective amount of the compound represented by structural formula (I),

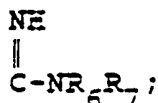


wherein R_1 is methyl or isopropyl; R_2 is hydrogen, methyl or hydrogen; X is oxygen, NOR_3 , or $NNHR_4$; R_3 is hydrogen, C_1 - C_6 alkyl, benzyl, allyl, propargyl, phenyl, CH_2COO -alkyl (C_1 - C_4), N -(C_1 - C_6 alkyl)carbamoyl, N -(allyl)carbamoyl, N -(propargyl)carbamoyl, N -(phenyl)carbamoyl, N -(chlorophenyl)carbamoyl, N -(dichlorophenyl)carbamoyl, N -(benzyl)carbamoyl, C_1 - C_6 alkanoyl, chloroacetyl, methox-

yacetyl, phenylacetyl, benzoyl and chlorobenzoyl; R_4 is

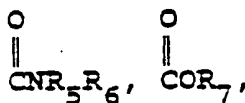


$\text{C}_1\text{-C}_4$ alkanoyl, $\text{C}_1\text{-C}_4$ alkyl, or



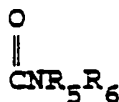
R_5 and R_6 are hydrogen or $\text{C}_1\text{-C}_4$ alkyl; and R_7 is $\text{C}_1\text{-C}_4$ alkyl; and the dotted triangular figure with oxygen at C(14,15) indicates that either a double bond or an epoxide is present.

12. A process according to Claim 11, wherein said compound is R_1 as isopropyl; R_2 as methyl; X is oxygen, NOR_3 , N-NHR_4 , and R_4 is



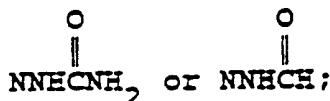
$\text{C}_1\text{-C}_4$ alkanoyl or $\text{C}_1\text{-C}_4$ alkyl.

13. The process according to Claim 12, wherein said compound is R_1 as isopropyl; R_2 is methyl; X is oxygen, NOR_3 or NNHR_4 ; R_4 is



or $\text{C}_1\text{-C}_4$ alkanoyl; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

14. The process according to Claim 11, wherein said compound is R_1 as isopropyl; R_2 is methyl; X is oxygen, NOCH_3 ,



and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

15. The process according to Claim 14, wherein, R_1 is isopropyl; R_2 is methyl; X is NOCH_3 ; and the dotted triangular figure with oxygen at C(14,15) represents a double bond.

Patentanspruch

Patentansprüche für folgend Vertragsstaaten: AT, BE, CH, DE, FR, GB, IT, LI, LU, NL, SE

1. Eine Verbindung der Strukturformel (I):

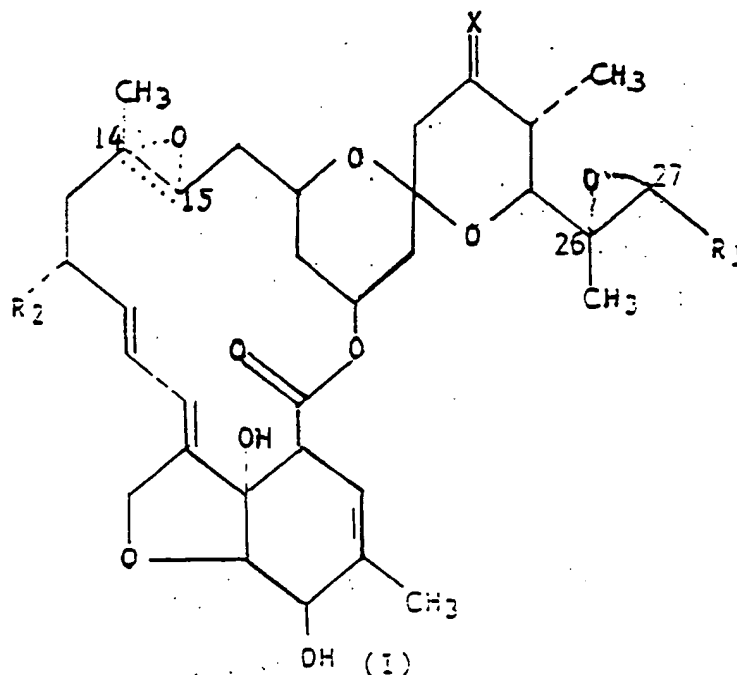
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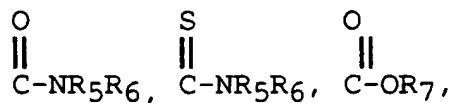


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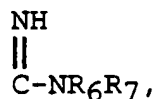
worin R_1 Methyl oder Isopropyl ist, R_2 Wasserstoff, Methyl oder Ethyl ist, X Sauerstoff, NOR_3 oder $NNHR_4$ ist, R_3 Wasserstoff, C_1-C_6 -Alkyl, Benzyl, Allyl, Propargyl, Phenyl, CH_2COO -Alkyl(C_1-C_4), N -(C_1-C_6 -Alkyl)carbamoyl, N -(Allyl)carbamoyl, N -(Propargyl)carbamoyl, N -(Phenyl)-carbamoyl, N -(Chlorphenyl)carbamoyl, N -(Dichlorphenyl)carbamoyl, N -(Benzyl)carbamoyl, C_1-C_6 -Alkanoyl, Chloracetyl, Methoxyacetyl, Phenylacetyl, Benzoyl und Chlorbenzoyl ist, R_4 ist

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C_1-C_4 -Alkanoyl, C_1-C_4 -Alkyl oder

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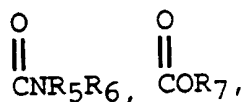


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R_5 und R_6 Wasserstoff oder C_1-C_4 -Alkyl sind und R_7 C_1-C_4 -Alkyl ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) anzeigt, daß entweder eine Doppelbindung oder ein Epoxid vorhanden ist, unter der Bedingung, daß, wenn am C(14,15) ein Epoxid oder eine Doppelbindung vorhanden ist und sowohl R_1 als auch R_2 beide Methyl sind oder R_1 Isopropyl und R_2 Methyl ist, X nicht Sauerstoff oder NOR_3 sein kann, bei dem R_3 für Wasserstoff, C_1-C_6 -Alkyl oder Allyl steht.

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2. Die Verbindung nach Anspruch 1, worin R_1 Isopropyl, R_2 Methyl, X Sauerstoff, NOR_3 oder $NNHR_4$ ist und R_4



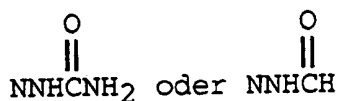
C₁-C₄-Alkanoyl oder C₁-C₄-Alkyl ist, unter der Bedingung des Anspruchs 1.

3. Die Verbindung nach Anspruch 2, worin R₁ Isopropyl, R₂ Methyl, X Sauerstoff, NOR₃ oder NNHR₄ ist, R₄



C₁-C₄-Alkanoyl ist, und die gestrichelte dreieckige Figur mit Sauerstoff am C(14,15) eine Doppelbindung repräsentiert.

4. Die Verbindung nach Anspruch 1, worin R₁ Isopropyl, R₂ Methyl, X Sauerstoff, NOCH₃,

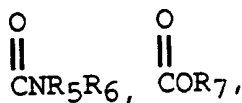


ist und die gestrichelte dreieckige Figur mit dem Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

5. Die Verbindung nach Anspruch 4, worin R₁ Isopropyl, R₂ Methyl, X NOCH₃ ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

6. Eine Verbindung nach Anspruch 1, zur Verwendung bei der Verhinderung, Behandlung oder Bekämpfung endoparasitärer oder ektoparasitärer Infektionen in warmblütigen Tieren.

7. Eine Verbindung zur Verwendung gemäß Anspruch 6, worin R₁ Isopropyl, R₂ Methyl, X Sauerstoff, NOR₃ oder N-NHR₄ ist und R₄



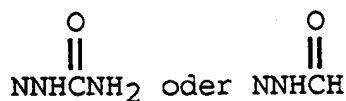
C₁-C₄-Alkanoyl oder C₁-C₄-Alkyl ist, unter der Bedingung des Anspruchs 1.

8. Die Verbindung nach Anspruch 7, worin R₁ Isopropyl, R₂ Methyl, X Sauerstoff, NOR₃ oder NNHR₄ ist, R₄



C₁-C₄-Alkanoyl ist, und die gestrichelte dreieckige Figur mit Sauerstoff am C(14,15) eine Doppelbindung repräsentiert.

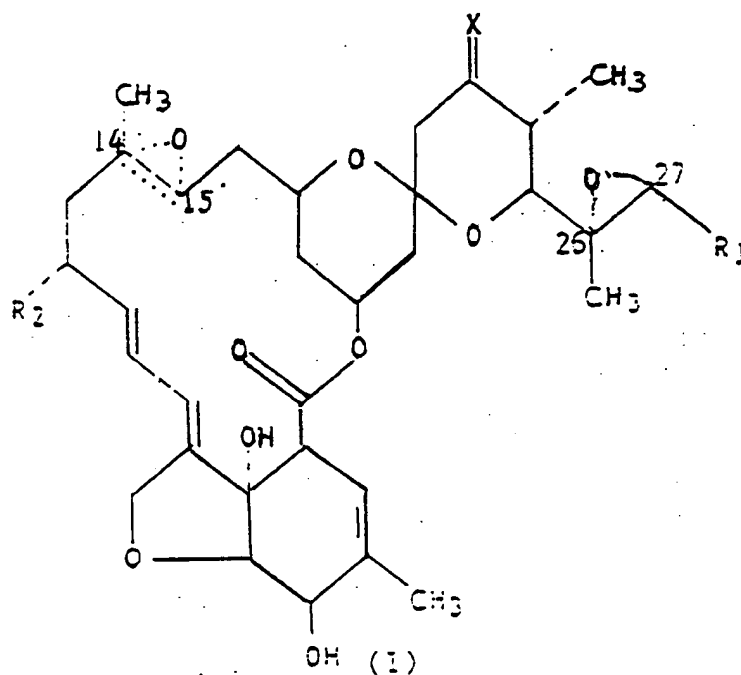
9. Die Verbindung nach Anspruch 6, worin R₁ Isopropyl, R₂ Methyl, X Sauerstoff, NOCH₃,



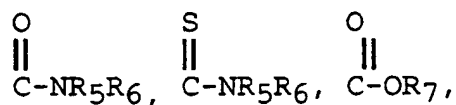
ist und die gestrichelte dreieckige Figur mit dem Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

10. Die Verbindung nach Anspruch 9, worin R₁ Isopropyl, R₂ Methyl, X NOCH₃ ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

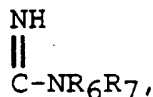
11. Ein Verfahren zum örtlichen oder systemischen Bekämpfen von Pflanzeninsekten und zum Schützen von Fruchtpflanzen, Bäumen, Sträuchern, gelagertem Getreide und Zierpflanzen, wobei das Verfahren die Anwendung einer wirksamen Menge einer Verbindung der Strukturformel (I) auf die wachsenden oder gelagerten Fruchtpflanzen umfaßt



worin R₁ Methyl oder Isopropyl ist, R₂ Wasserstoff, Methyl oder Ethyl ist, X Sauerstoff, NOR₃ oder N-NHR₄ ist, R₃ Wasserstoff, C₁-C₆-Alkyl, Benzyl, Allyl, Propargyl, Phenyl, CH₂COO-Alkyl(C₁-C₄), N-(C₁-C₆-Alkyl)carbamoyl, N-(Allyl)carbamoyl, N-(Propargyl)carbamoyl, N-(Phenyl)-carbamoyl, N-(Chlorphenyl)carbamoyl, N-(Dichlorphenyl)carbamoyl, N-(Benzyl)carbamoyl, C₁-C₆-Alkanoyl, Chloracetyl, Methoxyacetyl, Phenylacetyl, Benzoyl und Chlorbenzoyl ist, R₄ ist

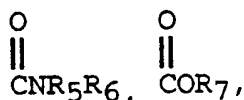


C₁-C₄-Alkanoyl, C₁-C₄-Alkyl oder



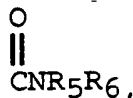
R_5 und R_6 Wasserstoff oder C_1 - C_4 -Alkyl sind und R_7 C_1 - C_4 -Alkyl ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) anzeigt, daß entweder eine Doppelbindung oder ein Epoxid vorhanden ist.

12. Ein Verfahren nach Anspruch 11, worin bei der Verbindung R_1 Isopropyl, R_2 Methyl, X Sauerstoff, NOR_3 oder NNHR_4 ist und R_4



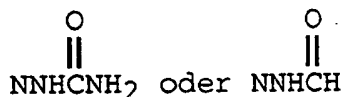
C_1 - C_4 -Alkanoyl oder C_1 - C_4 -Alkyl ist.

13. Das Verfahren gemäß Anspruch 12, worin bei der Verbindung R_1 Isopropyl, R_2 Methyl, X Sauerstoff, NOR_3 oder NNHR_4 ist, R_4



C_1 - C_4 -Alkanoyl ist, und die gestrichelte dreieckige Figur mit Sauerstoff am C(14,15) eine Doppelbindung repräsentiert.

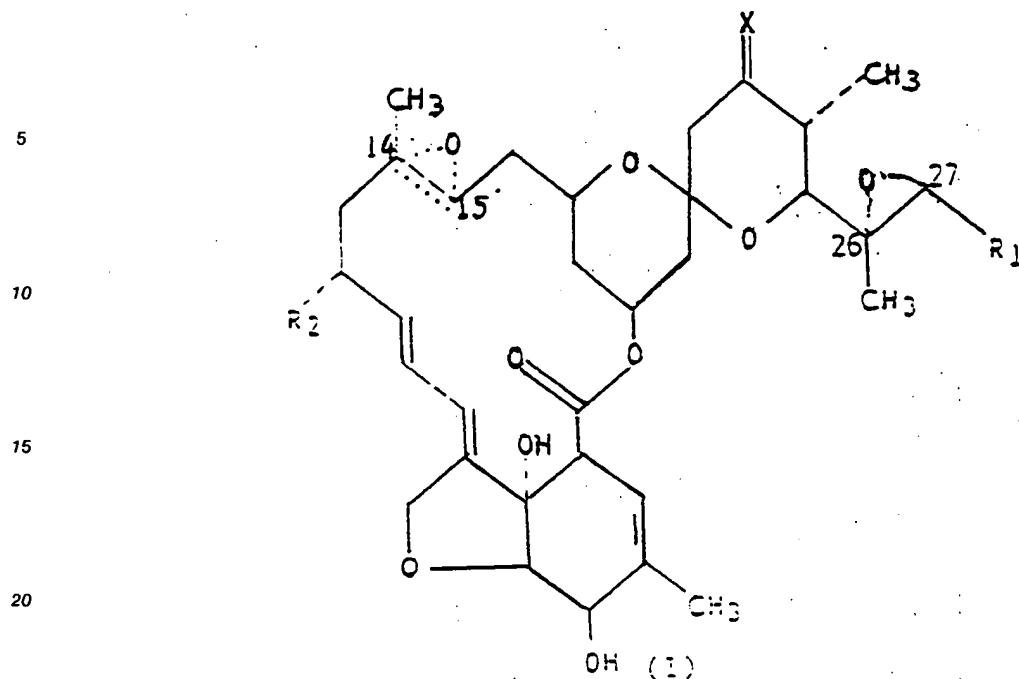
14. Das Verfahren nach Anspruch 11, worin bei der Verbindung R_1 Isopropyl, R_2 Methyl, X Sauerstoff, NOCH_3 ,



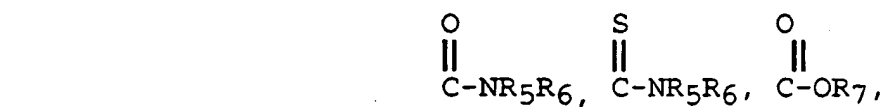
ist und die gestrichelte dreieckige Figur mit dem Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

15. Das Verfahren gemäß Anspruch 14, worin R_1 Isopropyl, R_2 Methyl, X NOCH_3 ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

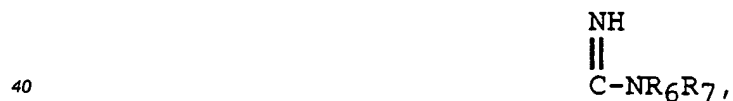
16. Ein Verfahren zum Bekämpfen von Pflanzennematoden, wobei das Verfahren das Anwenden auf das Laub der Pflanzen, den Boden, in dem sie gezogen werden oder in deren Stämme einer nematizidwirksamen Menge der durch die Strukturformel (I) repräsentierten Verbindung umfaßt



25 worin R₁ Methyl oder Isopropyl ist, R₂ Wasserstoff, Methyl oder Ethyl ist, X Sauerstoff, NOR₃ oder N-NHR₄ ist, R₃ Wasserstoff, C₁-C₆-Alkyl, Benzyl, Allyl, Propargyl, Phenyl, CH₂COO-Alkyl(C₁-C₄), N-(C₁-C₆-Alkyl)carbamoyl, N-(Allyl)carbamoyl, N-(Propargyl)carbamoyl, N-(Phenyl)-carbamoyl, N-(Chlorphenyl)carbamoyl, N-(Dichlorphenyl)carbamoyl, N-(Benzyl)carbamoyl, C₁-C₆-Alkanoyl, Chloracetyl, Methoxyacetyl, Phenylacetyl, Benzoyl und Chlorbenzoyl ist, R₄ ist



35 C₁-C₄-Alkanoyl, C₁-C₄-Alkyl oder



45 R₅ und R₆ Wasserstoff oder C₁-C₄-Alkyl sind und R₇ C₁-C₄-Alkyl ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) anzeigt, daß entweder eine Doppelbindung oder ein Epoxid vorhanden ist.

17. Ein Verfahren nach Anspruch 16, worin bei der Verbindung R₁ Isopropyl, R₂ Methyl, X Sauerstoff, NOR₃ oder NNHR₄ ist und R₄



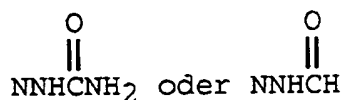
55 C₁-C₄-Alkanoyl oder C₁-C₄-Alkyl ist.

18. Das Verfahren gemäß Anspruch 17, worin bei der Verbindung R_1 Isopropyl, R_2 Methyl, X Sauerstoff, NOR_3 oder $NNHR_4$ ist, R_4



C_1 - C_4 -Alkanoyl ist, und die gestrichelte dreieckige Figur mit Sauerstoff am C(14,15) eine Doppelbindung repräsentiert.

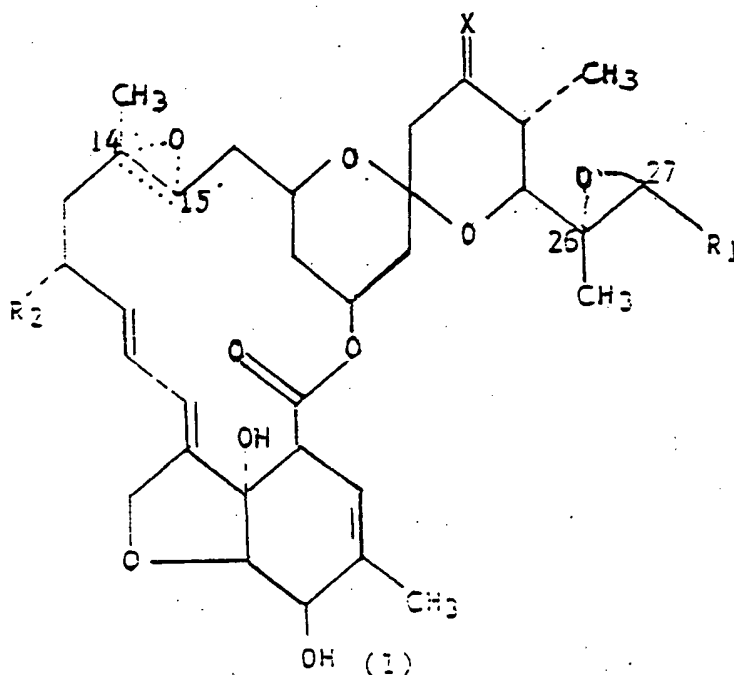
19. Das Verfahren nach Anspruch 16, worin bei der Verbindung R_1 Isopropyl, R_2 Methyl, X Sauerstoff, $NOCH_3$,



ist und die gestrichelte dreieckige Figur mit dem Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

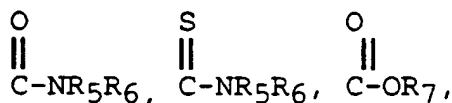
20. Das Verfahren gemäß Anspruch 19, worin R_1 Isopropyl, R_2 Methyl, X $NOCH_3$ ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

21. Eine Zusammensetzung zur Behandlung, Verhinderung oder Bekämpfung endo- und/oder ektoparasitärer Infektionen in warmblütigen Tieren, wobei die genannte Zusammensetzung umfaßt: eine prophylaktisch, therapeutisch oder pharmazeutisch wirksame Menge der durch die Strukturformel (I) repräsentierten Verbindung

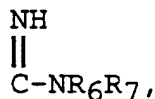


worin R_1 Methyl oder Isopropyl ist, R_2 Wasserstoff, Methyl oder Ethyl ist, X Sauerstoff, NOR_3 oder $NNHR_4$ ist, R_3 Wasserstoff, C_1 - C_6 -Alkyl, Benzyl, Allyl, Propargyl, Phenyl, CH_2COO -Alkyl(C_1 - C_4), N -(C_1 - C_6 -Alkyl)carbamoyl, N -(Allyl)carbamoyl, N -(Propargyl)carbamoyl, N -(Phenyl)-carbamoyl, N -

(Chlorphenyl)carbamoyl, N-(Dichlorphenyl)carbamoyl, N-(Benzyl)carbamoyl, C₁-C₆-Alkanoyl, Chloracetyl, Methoxyacetyl, Phenylacetyl, Benzoyl und Chlorbenzoyl ist, R₄ ist

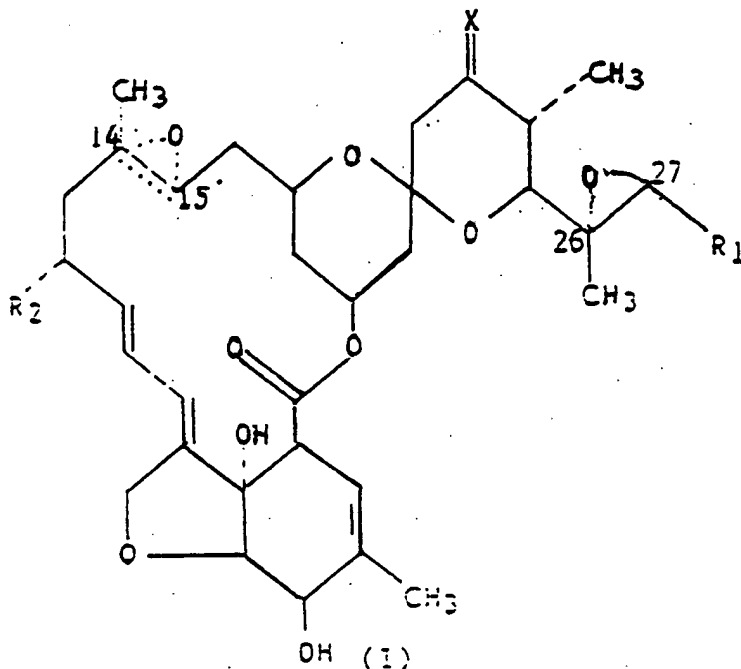


C₁-C₄-Alkanoyl, C₁-C₄-Alkyl oder

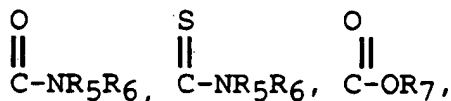


R₅ und R₆ Wasserstoff oder C₁-C₄-Alkyl sind und R₇ C₁-C₄-Alkyl ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) anzeigt, daß entweder eine Doppelbindung oder ein Epoxid vorhanden ist, unter der Bedingung des Anspruches 1, und einen inerten Träger.

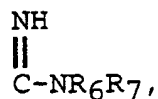
22. Eine Zusammensetzung zum Bekämpfen von Insekten, wobei die genannte Zusammensetzung umfaßt: eine insektizid wirksame Menge der durch die Strukturformel (I) repräsentierten Verbindung



worin R₁ Methyl oder Isopropyl ist, R₂ Wasserstoff, Methyl oder Ethyl ist, X Sauerstoff, NOR₃ oder N-NHR₄ ist, R₃ Wasserstoff, C₁-C₆-Alkyl, Benzyl, Allyl, Propargyl, Phenyl, CH₂COO-Alkyl(C₁-C₄), N-(C₁-C₆-Alkyl)carbamoyl, N-(Allyl)carbamoyl, N-(Propargyl)carbamoyl, N-(Phenyl)-carbamoyl, N-(Chlorphenyl)carbamoyl, N-(Dichlorphenyl)carbamoyl, N-(Benzyl)carbamoyl, C₁-C₆-Alkanoyl, Chloracetyl, Methoxyacetyl, Phenylacetyl, Benzoyl und Chlorbenzoyl ist, R₄ ist



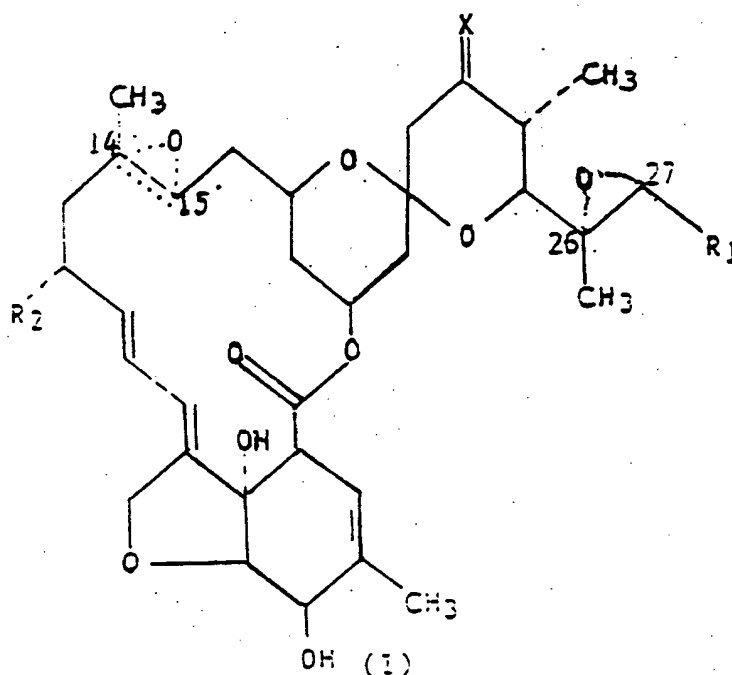
C₁-C₄-Alkanoyl, C₁-C₄-Alkyl oder



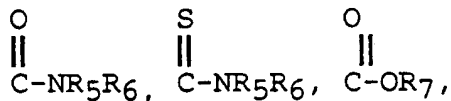
R_5 und R_6 Wasserstoff oder C_1 - C_4 -Alkyl sind und R_7 C_1 - C_4 -Alkyl ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) anzeigt, daß entweder eine Doppelbindung oder ein Epoxid vorhanden ist, unter der Bedingung des Anspruchs 1, und einen inerten Träger.

10 Patentansprüche für folgende Vertragsstaaten : ES, GR

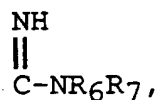
1. Ein Verfahren zum Herstellen einer Verbindung der Strukturformel (I):



worin R_1 Methyl oder Isopropyl ist, R_2 Wasserstoff, Methyl oder Ethyl ist, X Sauerstoff, NOR_3 oder N-NHR_4 ist, R_3 Wasserstoff, C_1 - C_6 -Alkyl, Benzyl, Allyl, Propargyl, Phenyl, $\text{CH}_2\text{COO-Alkyl}(\text{C}_1\text{-C}_4)$, $\text{N}(\text{C}_1\text{-C}_6\text{-Alkyl})\text{carbamoyl}$, $\text{N}(\text{Allyl})\text{carbamoyl}$, $\text{N}(\text{Propargyl})\text{carbamoyl}$, $\text{N}(\text{Phenyl})\text{carbamoyl}$, $\text{N}(\text{Chlorphenyl})\text{carbamoyl}$, $\text{N}(\text{Dichlorphenyl})\text{carbamoyl}$, $\text{N}(\text{Benzyl})\text{carbamoyl}$, C_1 - C_6 -Alkanoyl, Chloracetyl, Methoxyacetyl, Phenylacetyl, Benzoyl und Chlorbenzoyl ist, R_4 ist



C_1 - C_4 -Alkanoyl, C_1 - C_4 -Alkyl oder



R_5 und R_6 Wasserstoff oder C_1 - C_4 -Alkyl sind und R_7 C_1 - C_4 -Alkyl ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) anzeigt, daß entweder eine Doppelbindung oder ein Epoxid vorhanden ist, unter der Bedingung, daß, wenn am C(14,15) ein Epoxid oder eine Doppelbindung vorhanden ist und sowohl R_1 als auch R_2 beide Methyl sind oder R_1 Isopropyl und R_2 Methyl ist, X nicht Sauerstoff oder NOR_3 sein kann, bei dem R_3 für Wasserstoff, C_1 - C_6 -Alkyl oder Allyl steht, wobei das genannte Verfahren die folgenden Stufen umfaßt:

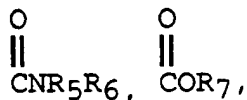
Behandeln einer geschützten LL-F28249-Verbindung mit einem milden Oxidationsmittel in einem inerten Lösungsmittel bei Temperaturen von weniger als $15^\circ C$, das die C(26,27)-Doppelbindung sowie die C(14,15)-Doppelbindung selektiv zu oxidieren in der Lage ist, die anderen Doppelbindungen im Molekül jedoch intakt läßt, um die entsprechende C(26,27)-Epoxy- oder die C(14,15;26,27)-Diepoxy-LL-F28249-Verbindung herzustellen,

Entfernen der Schutzgruppen an den 5- und 23-Hydroxylgruppen,

Schützen der 5-Hydroxylgruppe und Oxidieren der 23-Hydroxylgruppe der geschützten C(26,27)-Epoxy- oder C(14,15;26,27)-Diepoxy-LL-F28249-Verbindung, um das entsprechende 23-Oxo-Derivat zu erhalten und

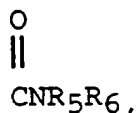
Entfernen der Schutzgruppe, um die erwünschte 23-Keto-C(26,27)-Epoxy- oder -C(14,15;26,27)-Diepoxy-LL-F28249-Verbindung der Formel (I) zu erhalten, in der $X = O$ und, gegebenenfalls, Umwandeln der 23-Oxo-Verbindung in ein Derivat der Formel (I), bei dem $X = NOR_3$ oder $NNHR_4$, worin R_3 und R_4 die oben genannte Bedeutung haben, in einer geeigneten Weise.

2. Das Verfahren nach Anspruch 1, worin R_1 Isopropyl, R_2 Methyl, X Sauerstoff, NOR_3 oder $NNHR_4$ ist und R_4



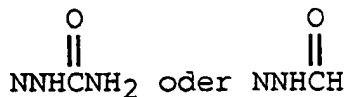
C_1 - C_4 -Alkanoyl oder C_1 - C_4 -Alkyl ist, unter der Bedingung des Anspruches 1.

3. Das Verfahren nach Anspruch 2, worin R_1 Isopropyl, R_2 Methyl, X Sauerstoff, NOR_3 oder $NNHR_4$ ist, R_4



oder C_1 - C_4 -Alkanoyl ist, und die gestrichelte dreieckige Figur mit Sauerstoff am C(14,15) eine Doppelbindung repräsentiert.

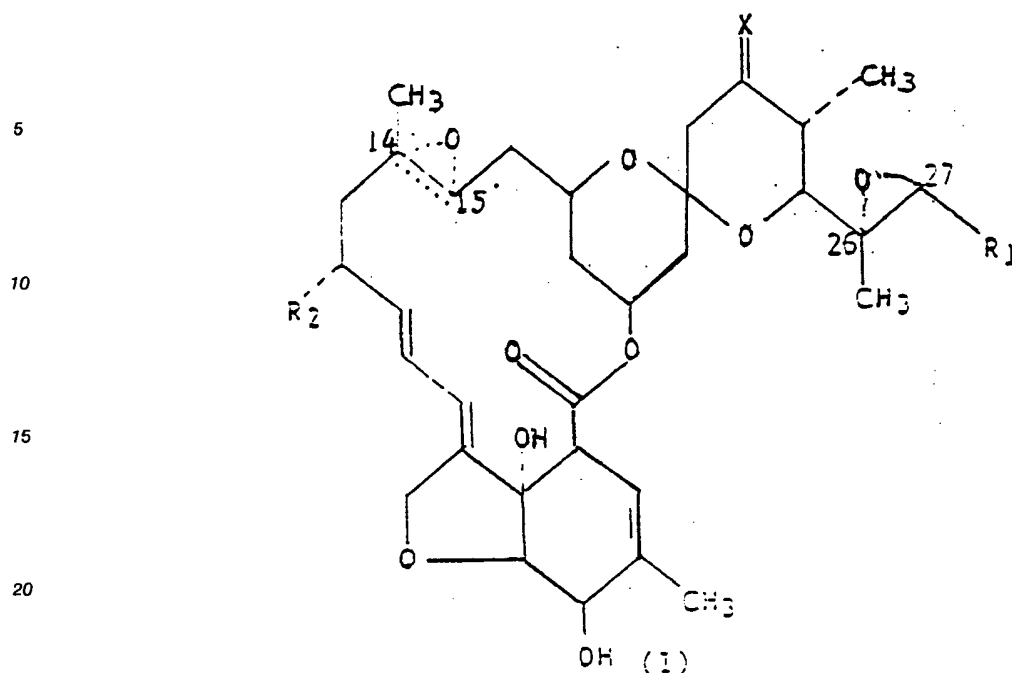
4. Das Verfahren nach Anspruch 1, worin R_1 Isopropyl, R_2 Methyl, X Sauerstoff, $NOCH_3$,



ist und die gestrichelte dreieckige Figur mit dem Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

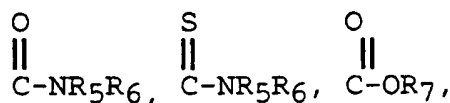
5. Das Verfahren nach Anspruch 4, worin R_1 Isopropyl, R_2 Methyl, X $NOCH_3$ ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

6. Ein Verfahren zum örtlichen oder systemischen Bekämpfen von Pflanzeninsekten und zum Schützen von Fruchtpflanzen, Bäumen, Sträuchern, gelagertem Getreide und Zierpflanzen, wobei das Verfahren die Anwendung einer wirksamen Menge einer Verbindung der Strukturformel (I) auf die wachsenden oder gelagerten Fruchtpflanzen umfaßt

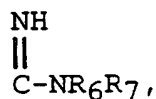


25 worin R₁ Methyl oder Isopropyl ist, R₂ Wasserstoff, Methyl oder Ethyl ist, X Sauerstoff, NOR₃ oder N-NHR₄ ist, R₃ Wasserstoff, C₁-C₆-Alkyl, Benzyl, Allyl, Propargyl, Phenyl, CH₂COO-Alkyl(C₁-C₄), N-(C₁-C₆-Alkyl)carbamoyl, N-(Allyl)carbamoyl, N-(Propargyl)carbamoyl, N-(Phenyl)-carbamoyl, N-(Chlorphenyl)carbamoyl, N-(Dichlorphenyl)carbamoyl, N-(Benzyl)carbamoyl, C₁-C₆-Alkanoyl, Chloracetyl, Methoxyacetyl, Phenylacetyl, Benzoyl und Chlorbenzoyl ist, R₄ ist

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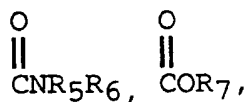


C₁-C₄-Alkanoyl, C₁-C₄-Alkyl oder



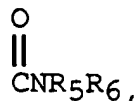
45 R₅ und R₆ Wasserstoff oder C₁-C₄-Alkyl sind und R₇ C₁-C₄-Alkyl ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) anzeigt, daß entweder eine Doppelbindung oder ein Epoxid vorhanden ist.

7. Ein Verfahren nach Anspruch 6, worin bei der Verbindung R₁ Isopropyl, R₂ Methyl, X Sauerstoff, NOR₃ oder NHHR₄ ist und R₄
- 50



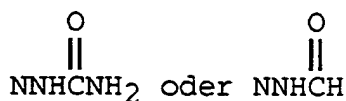
C₁-C₄-Alkanoyl oder C₁-C₄-Alkyl ist.

8. Das Verfahren gemäß Anspruch 7, worin bei der Verbindung R_1 Isopropyl, R_2 Methyl, X Sauerstoff, NOR_3 oder $NNHR_4$ ist, R_4



C_1 - C_4 -Alkanoyl ist, und die gestrichelte dreieckige Figur mit Sauerstoff am C(14,15) eine Doppelbindung repräsentiert.

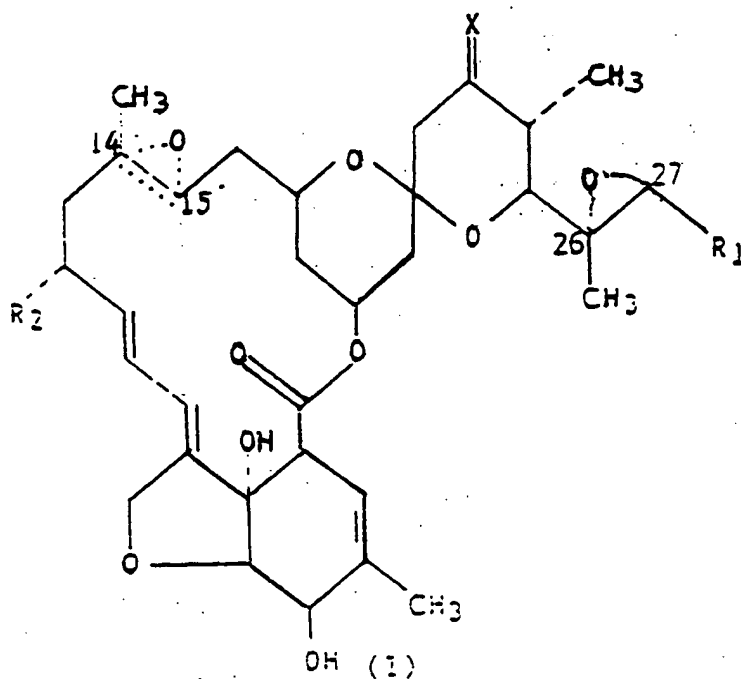
9. Das Verfahren nach Anspruch 6, worin bei der Verbindung R_1 Isopropyl, R_2 Methyl, X Sauerstoff, $NOCH_3$,



ist und die gestrichelte dreieckige Figur mit dem Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

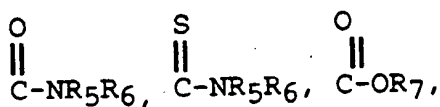
10. Das Verfahren gemäß Anspruch 9, worin R_1 Isopropyl, R_2 Methyl, X $NOCH_3$ ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C (14,15) eine Doppelbindung repräsentiert.

11. Ein Verfahren zum Bekämpfen von Pflanzennematoden, wobei das Verfahren das Anwenden auf das Laub der Pflanzen, den Boden, in dem sie gezogen werden oder in deren Stämme einer nematizid wirksamen Menge der durch die Strukturformel (I) repräsentierten Verbindung umfaßt

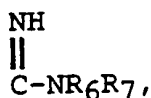


worin R_1 Methyl oder Isopropyl ist, R_2 Wasserstoff, Methyl oder Ethyl ist, X Sauerstoff, NOR_3 oder $NNHR_4$ ist, R_3 Wasserstoff, C_1 - C_6 -Alkyl, Benzyl, Allyl, Propargyl, Phenyl, CH_2COO -Alkyl(C_1 - C_4), N -(C_1 - C_6 -Alkyl)carbamoyl, N -(Allyl)carbamoyl, N -(Propargyl)carbamoyl, N -(Phenyl)-carbamoyl, N -(Chlorphenyl)carbamoyl, N -(Dichlorphenyl)carbamoyl, N -(Benzyl)carbamoyl, C_1 - C_6 -Alkanoyl, Chlorace-

tyl, Methoxyacetyl, Phenylacetyl, Benzoyl und Chlorbenzoyl ist, R_4 ist

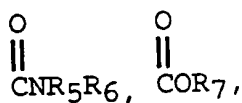


$\text{C}_1\text{-C}_4\text{-Alkanoyl}$, $\text{C}_1\text{-C}_4\text{-Alkyl}$ oder



R_5 und R_6 Wasserstoff oder $\text{C}_1\text{-C}_4\text{-Alkyl}$ sind und R_7 $\text{C}_1\text{-C}_4\text{-Alkyl}$ ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) anzeigt, daß entweder eine Doppelbindung oder ein Epoxid vorhanden ist.

12. Ein Verfahren nach Anspruch 11, worin bei der Verbindung R_1 Isopropyl, R_2 Methyl, X Sauerstoff, NOR_3 oder NNHR_4 ist und R_4



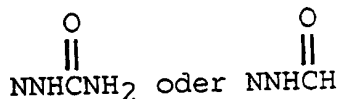
$\text{C}_1\text{-C}_4\text{-Alkanoyl}$ oder $\text{C}_1\text{-C}_4\text{-Alkyl}$ ist.

13. Das Verfahren gemäß Anspruch 12, worin bei der Verbindung R_1 Isopropyl, R_2 Methyl, X Sauerstoff, NOR_3 oder NNHR_4 ist, R_4



$\text{C}_1\text{-C}_4\text{-Alkanoyl}$ ist, und die gestrichelte dreieckige Figur mit Sauerstoff am C(14,15) eine Doppelbindung repräsentiert.

14. Das Verfahren nach Anspruch 11, worin bei der Verbindung R_1 Isopropyl, R_2 Methyl, X Sauerstoff, NOCH_3 ,



ist und die gestrichelte dreieckige Figur mit dem Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

15. Das Verfahren gemäß Anspruch 14, worin R_1 Isopropyl, R_2 Methyl, X NOCH_3 ist und die gestrichelte dreieckige Figur mit Sauerstoff beim C(14,15) eine Doppelbindung repräsentiert.

Revendications

Revendications pour les Etats contractants suivants : AT, BE, CH, DE, FR, GB, IT, LI, LU, NL, SE

1. Composé représenté par la formule développée (I) :

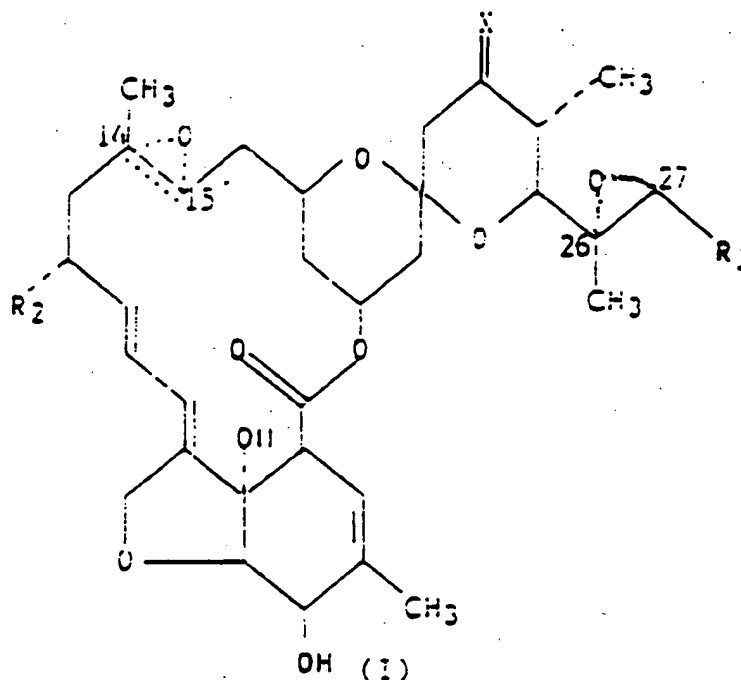
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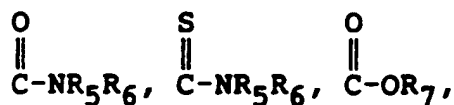


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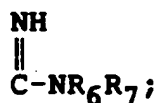
dans laquelle R₁ est un groupe méthyle ou isopropyle; R₂ est un atome d'hydrogène ou un groupe méthyle ou éthyle; X est un atome d'oxygène ou un groupe NOR₃ ou N-NHR₄; R₃ est un atome d'hydrogène ou un groupe alkyle en C₁-C₆, benzyle, allyle, propargyle, phényle, CH₃COO-alkyle (en C₁-C₄), N-(alkyle en C₁-C₆)carbamoyle, N-(allyl)carbamoyle, N-(propargyl)carbamoyle, N-(phényl)-carbamoyle, N-(chlorophényl)carbamoyle, N-(dichlorophényl)carbamoyle, N-(benzyl)carbamoyle, alcanoyle en C₁-C₆, chloroacétyle, méthoxyacétyle, phénylacétyle, benzoyle et chlorobenzoyle; R₄ est un groupe

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alcanoyle en C₁-C₄, alkyle en C₁-C₄ ou

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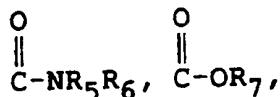


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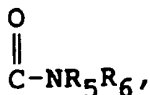
R₅ et R₆ sont des atomes d'hydrogène ou des groupes alkyle en C₁-C₄; et la figure triangulaire en pointillé avec l'oxygène en position C(14,15) indique la présence d'une double liaison ou d'un époxyde, à condition que, lorsqu'un époxyde ou une double liaison est présent sur le C(14,15) et lorsque les deux radicaux R₁ et R₂ sont des groupes méthyle ou que R₁ est un groupe isopropyle et R₂ est un groupe méthyle, X ne puisse pas être un atome d'oxygène ou un groupe NOR₃ avec R₃ représentant un atome d'hydrogène ou un groupe alkyle en C₁-C₆ ou allyle.

2. Composé selon la revendication 1, dans lequel R₁ est un groupe isopropyle; R₂ est un groupe méthyle; X est un atome d'oxygène ou un groupe NOR₃ ou NNHR₄; et R₄ est un groupe



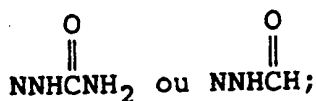
alcanoyle en C₁-C₄ ou alkyle en C₁-C₄, avec les conditions de la revendication 1.

3. Composé selon la revendication 2, dans lequel R₁ est un groupe isopropyle; R₂ est un groupe méthyle; X est un atome d'oxygène ou un groupe NOR₃ ou NNHR₄; R₄ est un groupe



ou alcanoyle en C₁-C₄; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

4. Composé selon la revendication 1, dans lequel R₁ est un groupe isopropyle; R₂ est un groupe méthyle; X est un atome d'oxygène ou un groupe NOCH₃,

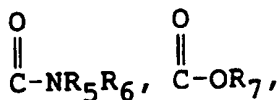


et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

5. Composé selon la revendication 4, dans lequel R₁ est un groupe isopropyle; R₂ est un groupe méthyle; X est un groupe NOCH₃; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

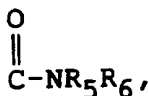
6. Composé selon la revendication 1, utilisable dans la prévention, le traitement ou la lutte contre les infections endoparasitaires ou ectoparasitaires chez les animaux à sang chaud.

7. Composé utilisable selon la revendication 6, dans lequel le composé est tel que R₁ soit un groupe isopropyle; R₂ soit un groupe méthyle; X soit un atome d'oxygène ou un groupe NOR₃ ou N-NHR₄; et R₄ soit un groupe



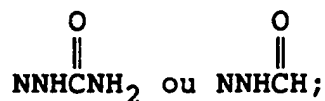
alcanoyle en C₁-C₄ ou alkyle en C₁-C₄, avec la condition de la revendication 1.

8. Composé selon la revendication 7, dans lequel ledit composé est tel que R₁ soit un groupe isopropyle; R₂ soit un groupe méthyle; X soit un atome d'oxygène ou un groupe NOR₃ ou NNHR₄; R₄ soit un groupe



ou alcanoyle en C₁-C₄; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

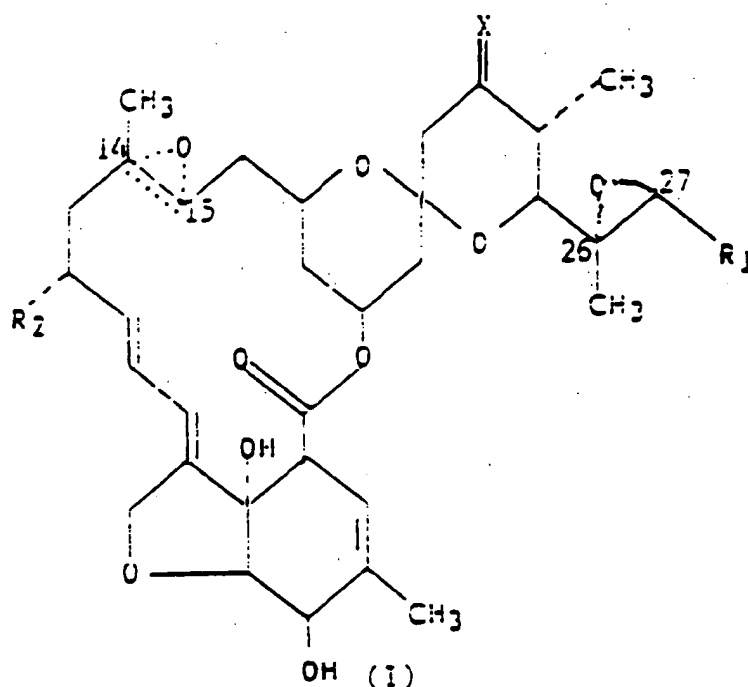
9. Composé selon la revendication 6, dans lequel ledit composé est tel que R_1 soit un groupe isopropyle; R_2 soit un groupe méthyle; X soit un atome d'oxygène ou un groupe NOCH_3 ,



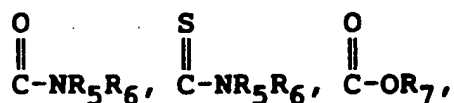
et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

10. Composé selon la revendication 9, dans lequel R_1 est un groupe isopropyle; R_2 est un groupe méthyle; X est un groupe NOCH_3 ; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C-(14,15) représente une double liaison.

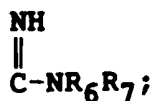
11. Procédé de lutte contre les insectes des plantes, de manière locale ou systémique, et de protection des cultures, des arbres, des arbustes, des grains stockés et des plantes ornementales, ledit procédé comprenant l'application sur les récoltes cultivées ou stockées d'une quantité efficace d'un composé représenté par la formule développée (I) :



dans laquelle R_1 est un groupe méthyle ou isopropyle; R_2 est un atome d'hydrogène ou un groupe méthyle ou éthyle; X est un atome d'oxygène ou un groupe NOR_3 ou N-NHR_4 ; R_3 est un atome d'hydrogène ou un groupe alkyle en C_1 - C_6 , benzyle, allyle, propargyle, phényle, CH_3COO -alkyle (en C_1 - C_4), N-(alkyle en C_1 - C_6)carbamoyle, N-(allyl)carbamoyle, N-(propargyl)carbamoyle, N-(phényl)-carbamoyle, N-(chlorophényl)carbamoyle, N-(dichlorophényl)carbamoyle, N-(benzyl)carbamoyle, alcanoyle en C_1 - C_6 , chloroacétyle, méthoxyacétyle, phénylacétyle, benzoyle et chlorobenzoyle; R_4 est un groupe

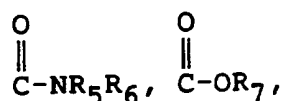


alcanoyle en C₁-C₄, alkyle en C₁-C₄ ou



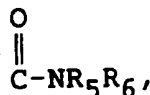
R₅ et R₆ sont des atomes d'hydrogène ou des groupes alkyle en C₁-C₄; et R₇ est un groupe alkyle en C₁-C₄; et la figure triangulaire en pointillé avec l'oxygène en position C(14,15) indique la présence d'une double liaison ou d'un époxyde.

12. Procédé selon la revendication 11, dans lequel ledit composé est tel que R₁ soit un groupe isopropyle; R₂ soit un groupe méthyle; X soit un atome d'oxygène ou un groupe NOR₃ ou NNHR₄; et R₄ soit un groupe



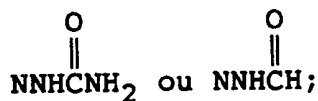
alcanoyle en C₁-C₄ ou alkyle en C₁-C₄.

13. Procédé selon la revendication 12, dans lequel ledit composé est tel que R₁ soit un groupe isopropyle; R₂ soit un groupe méthyle; X soit un atome d'oxygène ou un groupe NOR₃ ou NNHR₄; R₄ soit un groupe



ou alcanoyle en C₁-C₄; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

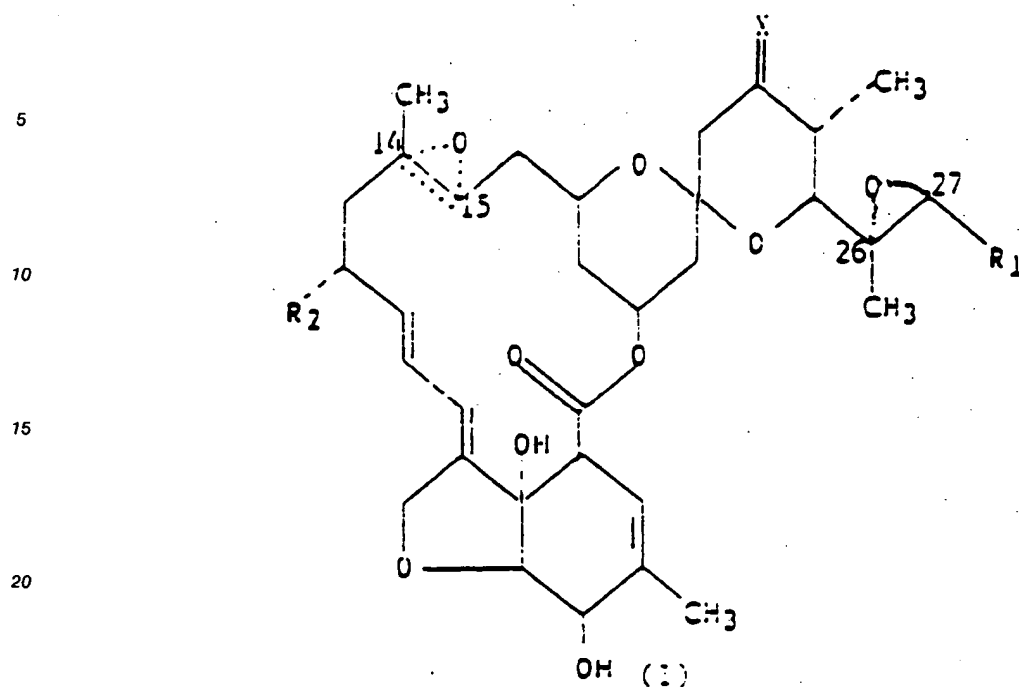
14. Procédé selon la revendication 11, dans lequel ledit composé est tel que R₁ soit un groupe isopropyle; R₂ soit un groupe méthyle; X soit un atome d'oxygène ou un groupe NOCH₃,



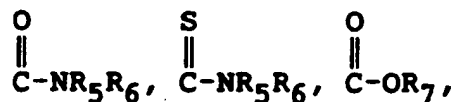
et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

15. Procédé selon la revendication 14, dans lequel R₁ est un groupe isopropyle; R₂ est un groupe méthyle; X est un groupe NOCH₃; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

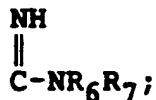
16. Procédé de lutte contre les nématodes des plantes, ledit procédé comprenant : l'application sur le feuillage des plantes, sur le sol dans lequel elles sont cultivées ou dans leurs troncs, d'une quantité efficace comme nématicide du composé représenté par la formule développée (I) :



dans laquelle R_1 est un groupe méthyle ou isopropyle; R_2 est un atome d'hydrogène ou un groupe méthyle ou éthyle; X est un atome d'oxygène ou un groupe NOR_3 ou $N-NHR_4$; R_3 est un atome d'hydrogène ou un groupe alkyle en C_1-C_6 , benzyle, allyle, propargyle, phényle, CH_3COO -alkyle (en C_1-C_4), N -(alkyle en C_1-C_6)carbamoyle, N -(allyl)carbamoyle, N -(propargyl)carbamoyle, N -(phényl)carbamoyle, N -(chlorophényl)carbamoyle, N -(dichlorophényl)carbamoyle, N -(benzyl)carbamoyle, alcanoyle en C_1-C_6 , chloroacétyle, méthoxyacétyle, phénylacétyle, benzoyle et chlorobenzoyle; R_4 est un groupe

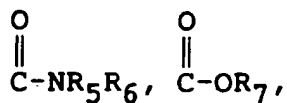


alcanoyle en C_1-C_4 , alkyle en C_1-C_4 ou



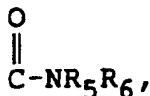
R_5 et R_6 sont des atomes d'hydrogène ou des groupes alkyle en C_1-C_4 ; et R_7 est un groupe alkyle en C_1-C_4 ; et la figure triangulaire en pointillé avec l'oxygène en position C(14,15) indique la présence d'une double liaison ou d'un époxyde.

17. Procédé selon la revendication 16, dans lequel ledit composé est tel que R_1 soit un groupe isopropyle; R_2 soit un groupe méthyle; X soit un atome d'oxygène ou un groupe NOR_3 ou $NNHR_4$; et R_4 soit un groupe



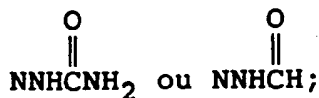
alcanoyle en C₁-C₄ ou alkyle en C₁-C₄.

18. Procédé selon la revendication 17, dans lequel ledit composé est tel que R₁ soit un groupe isopropyle; R₂ soit un groupe méthyle; X soit un atome d'oxygène ou un groupe NOR₃ ou NNHR₄; R₄ soit un groupe



ou alcanoyle en C₁-C₄; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

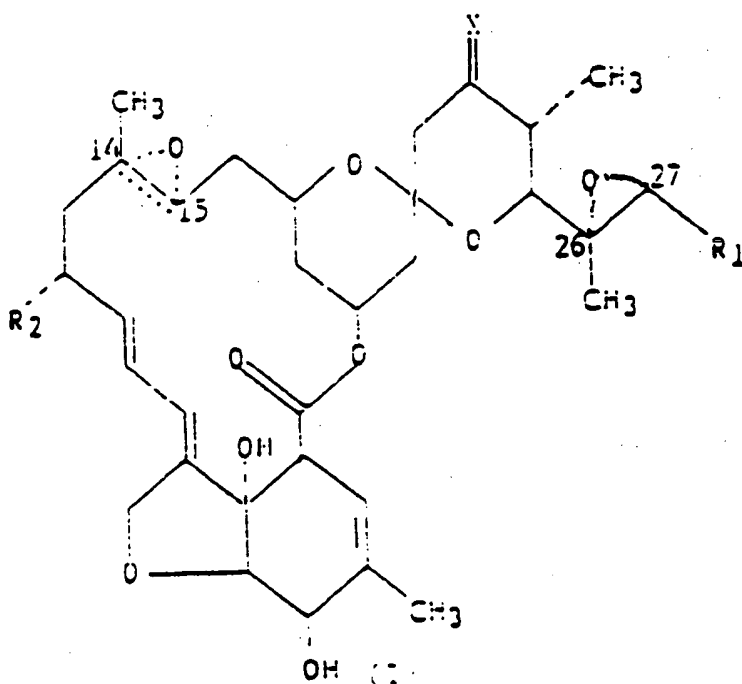
19. Procédé selon la revendication 16, dans lequel ledit composé est tel que R₁ soit un groupe isopropyle; R₂ soit un groupe méthyle; X soit un atome d'oxygène ou un groupe NOCH₃,



et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

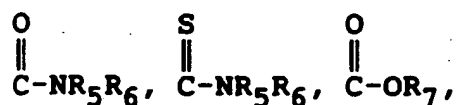
20. Procédé selon la revendication 19, dans lequel R₁ est un groupe isopropyle; R₂ est un groupe méthyle; X est un groupe NOCH₃; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

21. Composition pour traiter, prévenir ou circonscrire les infections endo- et/ou ectoparasitaires chez les animaux à sang chaud, ladite composition comprenant : une quantité efficace sur le plan prophylactique, thérapeutique ou pharmaceutique du composé représenté par la formule développée (I) :

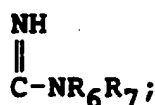


dans laquelle R₁ est un groupe méthyle ou isopropyle; R₂ est un atome d'hydrogène ou un groupe

méthyle ou éthyle; X est un atome d'oxygène ou un groupe NOR₃ ou N-NHR₄; R₃ est un atome d'hydrogène ou un groupe alkyle en C₁-C₆, benzyle, allyle, propargyle, phényle, CH₃COO-alkyle (en C₁-C₄), N-(alkyl en C₁-C₆)carbamoyle, N-(allyl)carbamoyle, N-(propargyl)carbamoyle, N-(phényl)carbamoyle, N-(chlorophényl)carbamoyle, N-(dichlorophényl)carbamoyle, N-(benzyl)carbamoyle, alcanoyle en C₁-C₆, chloroacétyle, méthoxyacétyle, phénylacétyle, benzoyle et chlorobenzoyle; R₄ est un groupe

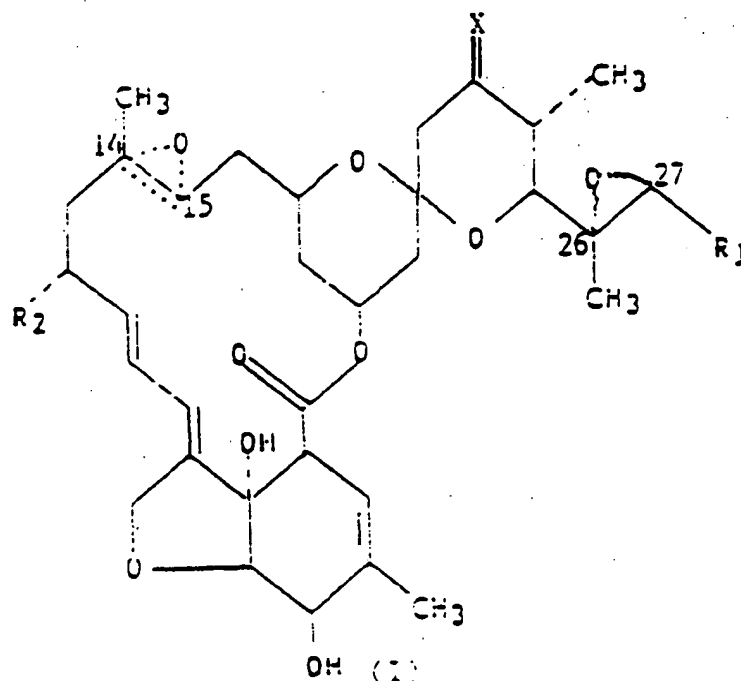


alcanoyle en C₁-C₄, alkyle en C₁-C₄ ou

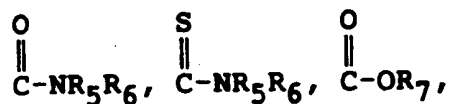


R₅ et R₆ sont des atomes d'hydrogène ou des groupes alkyle en C₁-C₄; et R₇ est un groupe alkyle en C₁-C₄; et la figure triangulaire en pointillé avec l'oxygène en position C(14,15) indique la présence d'une double liaison ou d'un époxyde, avec les conditions de la revendication 1, et un véhicule inerte.

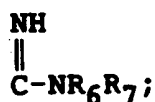
22. Composition de lutte contre les insectes, ladite composition comprenant : une quantité efficace comme insecticide du composé représenté par la formule développée (I) :



dans laquelle R₁ est un groupe méthyle ou isopropyle; R₂ est un atome d'hydrogène ou un groupe méthyle ou éthyle; X est un atome d'oxygène ou groupe NOR₃ ou N-NHR₄; R₃ est un atome d'hydrogène ou un groupe alkyle en C₁-C₆, benzyle, allyle, propargyle, phényle, CH₃COO-alkyle (en C₁-C₄), N-(alkyl en C₁-C₆)carbamoyle, N-(allyl)carbamoyle, N-(propargyl)carbamoyle, N-(phényl)-carbamoyle, N-(chlorophényl)carbamoyle, N-(dichlorophényl)carbamoyle, N-(benzyl)carbamoyle, alcanoyle en C₁-C₆, chloroacétyle, méthoxyacétyle, phénylacétyle, benzoyle et chlorobenzoyle; R₄ est un groupe



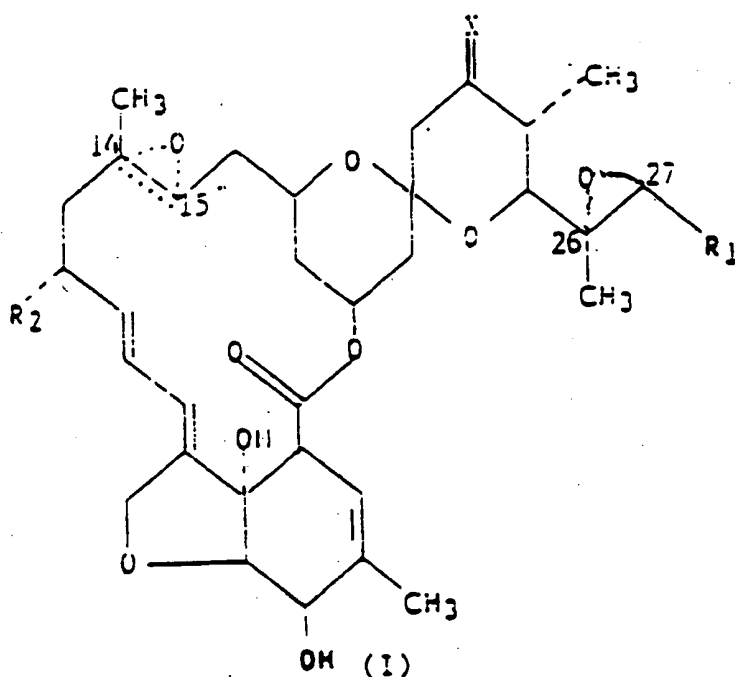
alcanoyle en C₁-C₄, alkyle en C₁-C₄ ou



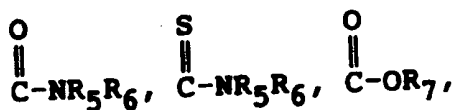
R₅ et R₆ sont des atomes d'hydrogène ou des groupes alkyle en C₁-C₄; et R₇ est un groupe alkyle en C₁-C₄; et la figure triangulaire en pointillé avec l'oxygène en position C(14,15) indique la présence d'une double liaison ou d'un époxyde, avec les conditions de la revendication 1, et un véhicule inerte.

Revendications pour les Etats contractants suivants : ES, GR

1. Méthode de préparation d'un composé représenté par la formule générale (I) :

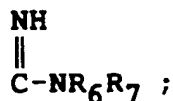


dans laquelle R₁ est un groupe méthyle ou isopropyle ; R₂ est un atome d'hydrogène ou un groupe méthyle ou éthyle ; X est un atome d'oxygène ou un groupe NOR₃ ou N-NHR₄ ; R₃ est un atome d'hydrogène ou un groupe alkyle en C₁-C₆, benzyle, allyle, propargyle, phényle, CH₃COO-alkyle (en C₁-C₄), N-(alkyle en C₁-C₆)carbamoyle, N-(allyl)carbamoyle, N-(propargyl)carbamoyle, N-(phényl)-carbamoyle, N-(chlorophényl)-carbamoyle, N-(dichlorophényl)carbamoyle, N-(benzyl)carbamoyle, alcanoyle en C₁-C₆, chloroacétyle, méthoxyacétyle, phénylacétyle, benzoyle et chlorobenzoyle ; R₄ est un groupe



alcanoyle en C₁-C₄, alkyle en C₁-C₄ ou

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R₅ et R₆ sont des atomes d'hydrogène ou des groupes alkyle en C₁-C₄ ; et la figure triangulaire en pointillé avec l'oxygène en position C(14, 15) indique la présence d'une double liaison ou d'un époxyde, à condition que, lorsqu'un époxyde ou une double liaison est présent sur le C(14,15) et lorsque les deux radicaux R₁ et R₂ sont des groupes méthyle ou que R₁ est un groupe isopropyle et R₂ est un groupe méthyle, X ne puisse pas être un atome d'oxygène ou un groupe NOR₃ avec R₃ représentant un atome d'hydrogène ou un groupe alkyle en C₁-C₆ ou allyle, ladite méthode comprenant les étapes suivantes :

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- traiter un composé LL-F2 8249 protégé avec un agent faiblement oxydant capable d'oxyder sélectivement la double liaison en C(26,27), ainsi que la double liaison en C(14,15), mais laissera intacte les autres doubles liaisons de la molécule, pour préparer le composé correspondant C-(26,27)-époxy ou C(14,15 ; 26,27)-diépoxy-LL-F2 8249, dans un solvant inerte à une température inférieure à -15 °C ;

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- éliminer les groupes protecteurs au niveau des groupes hydroxy 5 et 23 ;
- protéger le groupe 5-hydroxy et soumettre le groupe 23-hydroxy du composé C(26,27)-époxy ou C(14,15 ; 26,27)-diépoxy-LL-F2 8249 protégé à une oxydation pour obtenir le dérivé correspondant 23-oxo ; et

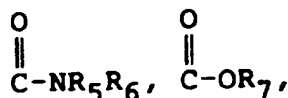
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- éliminer le groupe protecteur pour obtenir le composé désiré 23-céto-C(26,27)-époxy ou C(14,15 ; 26,27)diépoxy-LL-F2 8249 de formule (I) dans laquelle X = O, et, optionnellement, convertir le dérivé 23-oxo en un dérivé de formule (I) dans laquelle X = NOR₃ ou N-NHR₄, dans laquelle R₃ et R₄ sont tels que définis au-dessus, d'une manière représentée.

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2. Méthode selon la revendication 1, dans lequel R₁ est un groupe isopropyle ; R₂ est un groupe méthyle ; X est un atome d'oxygène ou un groupe NOR₃ ou NNHR₄ ; et R₄ est un groupe

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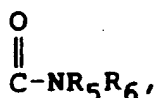


alcanoyle en C₁-C₄ ou alkyle en C₁-C₄, avec les conditions de la revendication 1.

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3. Méthode selon la revendication 2, dans lequel R₁ est un groupe isopropyle ; R₂ est un groupe méthyle ; X est un atome d'oxygène ou un groupe NOR₃ ou NNHR₄ ; R₄ est un groupe

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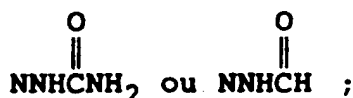


ou alcanoyle en C₁-C₄ ; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

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4. Méthode selon la revendication 1, dans lequel R₁ est un groupe isopropyle ; R₂ est un groupe méthyle ; X est un atome d'oxygène ou un groupe NOCH₃,

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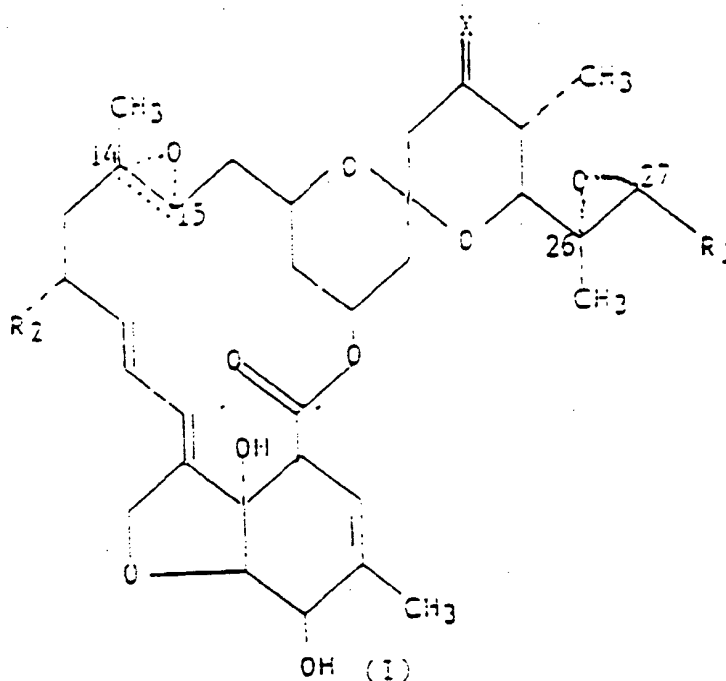


et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double

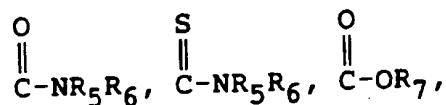
liaison.

5. Méthode selon la revendication 4, dans lequel R_1 est un groupe isopropyle, R_2 est un groupe méthyle ; X est un groupe NOCH_3 ; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C-(14,15) représente une double liaison.

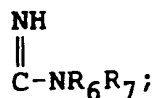
6. Procédé de lutte contre les insectes des plantes, de manière locale ou systémique, et de protection des cultures, des arbres, des arbustes, des grains stockés et des plantes ornementales, ledit procédé comprenant l'application sur les récoltes cultivées ou stockées d'une quantité efficace d'un composé représenté par la formule développée (I) :



dans laquelle R_1 est un groupe méthyle ou isopropyle ; R_2 est un atome d'hydrogène ou un groupe méthyle ou éthyle ; X est un atome d'oxygène ou un groupe NOR_3 ou N-NHR_4 ; R_3 est un atome d'hydrogène ou un groupe alkyle en $\text{C}_1\text{-C}_6$, benzyle, allyle, propargyle, phényle, $\text{CH}_3\text{COO-alkyle}$ (en $\text{C}_1\text{-C}_4$), N-(alkyl en $\text{C}_1\text{-C}_6$)carbamoyle, N-(allyl)carbamoyle, N-(propargyl)carbamoyle, N-(phényl)carbamoyle, N-(chlorophényl)-carbamoyle, N-(dichlorophényl)carbamoyle, N-(benzyl)carbamoyle, alcanoyle en $\text{C}_1\text{-C}_6$, chloroacétyle, méthoxyacétyle, phénylacétyle, benzoyle et chlorobenzoyle ; R_4 est un groupe

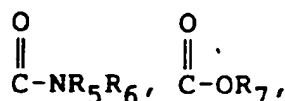


alcanoyle en $\text{C}_1\text{-C}_4$, alkyle en $\text{C}_1\text{-C}_4$ ou



R_5 et R_6 sont des atomes d'hydrogène ou des groupes alkyle en $\text{C}_1\text{-C}_4$; et R_7 est un groupe alkyle en $\text{C}_1\text{-C}_4$; et la figure triangulaire en pointillé avec l'oxygène en position C(14,15) indique la présence d'une double liaison ou d'un époxyde.

7. Procédé selon la revendication 6, dans lequel ledit composé est tel que R₁ soit un groupe isopropyle ; R₂ soit un groupe méthyle ; X soit un atome d'oxygène ou un groupe NOR₃ ou NNHR₄ ; et R₄ soit un groupe



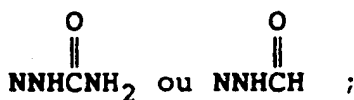
10 alcanoyle en C₁-C₄ ou alkyle en C₁-C₄.

8. Procédé selon la revendication 7, dans lequel ledit composé est tel que R₁ soit un groupe isopropyle ; R₂ soit un groupe méthyle ; X soit un atome d'oxygène ou un groupe NOR₃ ou NNHR₄ ; R₄ soit un groupe



20 ou alcanoyle en C₁-C₄ ; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

9. Procédé selon la revendication 6, dans lequel ledit composé est tel que R₁ soit un groupe isopropyle ; R₂ soit un groupe méthyle ; X soit un atome d'oxygène ou un groupe NOCH₃,



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et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

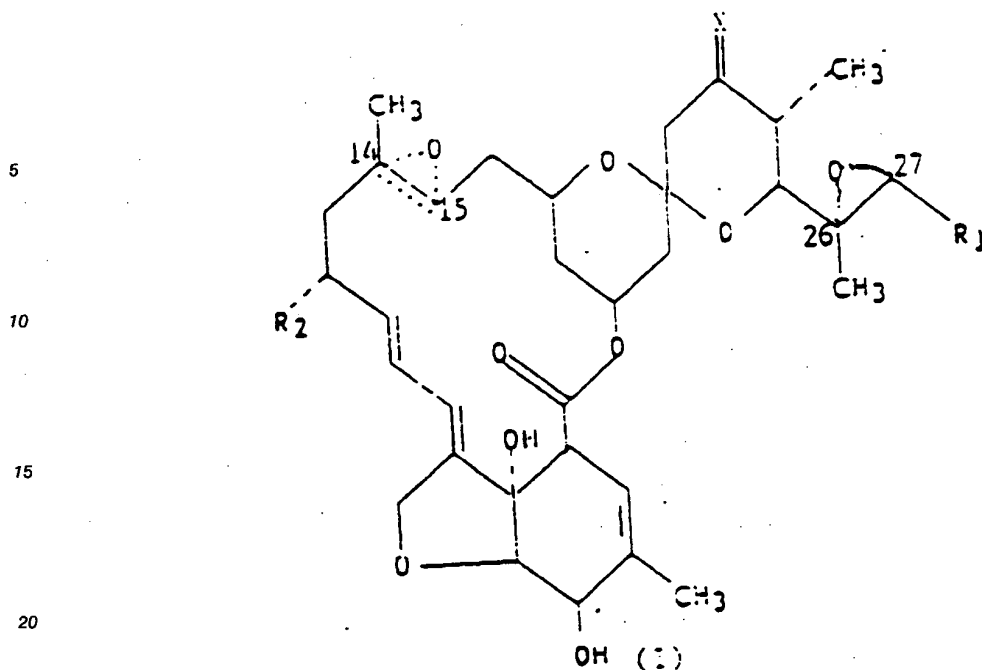
10. Procédé selon la revendication 9, dans lequel R₁ est un groupe isopropyle ; R₂ est un groupe méthyle ; X est un groupe NOCH₃ ; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

11. Procédé de lutte contre les nématodes des plantes, ledit procédé comprenant : l'application sur le feuillage des plantes, sur le sol dans lequel elles sont cultivées ou dans leurs troncs, d'une quantité efficace comme nématicide du composé représenté par la formule développée (I) :

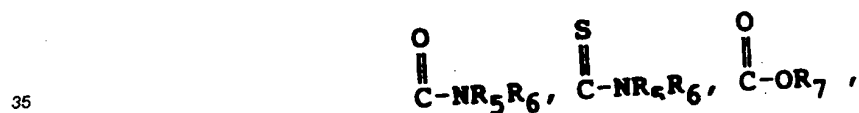
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dans laquelle R_1 est un groupe méthyle ou isopropyle ; R_2 est un atome d'hydrogène ou un groupe méthyle ou éthyle ; X est un atome d'oxygène ou un groupe NOR_3 ou $N-NHR_4$; R_3 est un atome d'hydrogène ou un groupe alkyle en C_1-C_6 , benzyle, allyle, propargyle, phényle, CH_3COO -alkyle (en C_1-C_4), N -(alkyle en C_1-C_6)carbamoyle, N -(allyl)carbamoyle, N -(propargyl)carbamoyle, N -(phényl)carbamoyle, N -(chlorophényl)-carbamoyle, N -(dichlorophényl)carbamoyle, N -(benzyl)carbamoyle, alcanoyle en C_1-C_6 , chloroacétyle, méthoxyacétyle, phénylacétyle, benzoyle et chlorobenzoyle ; R_4 est un groupe



alcanoyle en C_1-C_4 , alkyle en C_1-C_4 ou



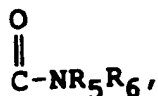
R_5 et R_6 sont des atomes d'hydrogène ou des groupes alkyle en C_1-C_4 ; et R_7 est un groupe alkyle en C_1-C_4 ; et la figure triangulaire en pointillé avec l'oxygène en position C(14,15) indique la présence d'une double liaison ou d'un époxyde.

12. Procédé selon la revendication 11, dans lequel ledit composé est tel que R_1 soit un groupe isopropyle ; R_2 soit un groupe méthyle ; X soit un atome d'oxygène ou un groupe NOR_3 ou $NNHR_4$; et R_4 soit un groupe



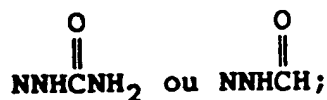
alcanoyle en C_1-C_4 ou alkyle en C_1-C_4 .

13. Procédé selon la revendication 12, dans lequel ledit composé est tel que R₁ soit un groupe isopropyle ; R₂ soit un groupe méthyle ; X soit un atome d'oxygène ou un groupe NOR₃ ou NNHR₄ ; R₄ soit un groupe



ou alcanoylé en C₁-C₄ ; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

14. Procédé selon la revendication 11, dans lequel ledit composé est tel que R₁ soit un groupe isopropyle ; R₂ soit un groupe méthyle ; X soit un atome d'oxygène ou un groupe NOCH₃,



et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

15. Procédé selon la revendication 14, dans lequel R₁ est un groupe isopropyle ; R₂ est un groupe méthyle ; X est un groupe NOCH₃ ; et la figure triangulaire en pointillé avec l'atome d'oxygène en position C(14,15) représente une double liaison.

